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A National Environmental/Energy Workforce Assessment. Tennessee

National Field Research Center, Inc, Iowa City, Iowa

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A National Environmental/Energy Workforce Assessment

TENNESSEE

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16. ABSTRACT

This study is one of 70 volumes assessing the workforce needs (manpower needs) for pollution control and abatement in the United States for the five-year period of 1976 through 1981. Seven fields for pollution control — air, noise, pesticides, potable water, radiation, solid waste, and wastewater — are analyzed, together with energy-related programs currently accentuated by the national effort to solve energy supply problems.

Designed as Phase I of a three-phase program, the complete assessment includes the following volumes: one each for the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands; one for each of the ten EPA regions; a one-volume National Abstract; a volume on National Legislation; a volume on Business and Industry; and a four-volume National Summary. The information was gathered through extensive personal interviews with responsible federal, state, and local officials in every state; with officials of representative private industrial and commercial firms; and with representatives of national industrial and trade organizations.

Phase II will develop a broad national inventory of the entire range of post-secondary and higher education training offered in the pollution control and energy areas cited above, and Phase III will offer demonstrations for curriculum changes or modifications which appear necessary to assure an adequate and properly trained national environmental/energy workforce.

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WORKFORCE ASSESSMENT

for

TENNESSEE

Conducted by:
NATIONAL FIELD RESEARCH CENTER, INC

Under Grant from:
UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
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1977

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PREFACE

This report presents existing workforce levels, training programs, and career potentials and develops staffing level projections (1976-1982) based upon available information for the State of Tennessee in the environmental pollution control areas of air, noise, potable water, pesticides, radiation, solid waste, waste water, and energy. This study was carried out for the United States Environmental Protection Agency by National Field Research Center of Iowa City, Iowa.

The information and data presented in this report were compiled in large part from extensive interviews with professionals working in the respective areas and were supplemented by telephone surveys and research.

FOREWORD

The material herein contains the information and data collected for eight individual pollution control inventories conducted for Tennessee. The format includes workforce profiles, projections, growth and career potential for each of the areas investigated. Growth projections are necessarily best professional estimates developed from available information and represent what are felt to be realistic figures by experts in the respective areas. The pollution areas considered by this study are as follows:

Air

Noise

Pesticides

Potable Water

Radiation

Solid Waste

Waste Water

Energy

National Environmental Energy Workforce Assessment

Phase I

TENNESSEE

State Summary

I. AIR

The Tennessee Department of Public Health, Bureau of Environmental Health Services, is responsible for the implementation and enforcement of the state's Air Quality Act. Knox, Hamilton, Davidson and Shelby Counties are authorized to administer local air programs. The state agency employs 90 persons for air pollution control, consisting chiefly of engineers, scientists and technicians. The Knox program employs 11 staff members, Hamilton, 22, Davidson, 13 and Shelby, 13, with the same personnel as the state agency. Available information indicates that there are approximately 850 persons in Tennessee employed in air pollution control positions in other governmental agencies and private industry.

Growth in the state program is not expected to occur. Of the four local programs, only the Nashville program will grow, according to officials, if it acquires responsibility for enforcing motor vehicle inspection/maintenance regulations.

The career potential for all occupations within the air pollution control fields in the state is reasonably stable. However, even though workforce requirements for personnel have somewhat stabilized compared to the last five years, there will be a continuing demand for qualified personnel at all levels within the air pollution control field. In addition, it is important to note that technically oriented training programs for professionals are considered inadequate by officials although the training committee formed by Region IV EPA is assisting in meeting training needs.

II. NOISE

Tennessee has not enacted any noise legislation on a statewide basis. The State Legislature commissioned a joint committee study concerning noise pollution, and the Commissioner of Public Health was designated to supervise this study. The Division's Technical Services Branch reviews citizen complaints but, without legislative authority, is unable to take substantive action. Sources are hopeful that legislation will be adopted within the next several years. The first year's program will require three to four persons, and further expansion is anticipated.

In the Nashville-Davidson County Health Department, one person works part-time in noise althouth the county has no regulations for enforcement. In Memphis, the police department has authority to enforce nuisance and vehicle regulations, but no acoustical criteria are included in the regulations. The Chattanooga-Hamilton County Air Pollution Control Bureau recently completed a noise survey and takes citizen complaints concerning noise pollution problems, although it has no regulations to enforce. The Bureau plans to add a noise component to its program once regulations including acoustical criteria are enacted in the county. The staff will initially include three persons.

State sources regard the noise pollution field as a relatively new program area and will rely on the impetus and support of the Environmental Protection Agency for the development of a comprehensive program. If such a program is developed, the career potential in the field will markedly improve.

III. PESTICIDES

The Plant Industries Division of the Tennessee Department of Agriculture holds responsibility for the implementation of the state's pesticide programs. The Cooperative Extension Service provides training to pesticide applicators. The Food and Drug Division of the Department of Agriculture performs pesticide-related analyses. The Plant Industries Division employs eleven persons: two administrators, five inspectors, one chemist and three secretaries. The Food and Drug Division employs three chemists. The Extension Service utilizes ten extension specialists, and 94 county agents train private applicators. An additional 28 positions are projected to be added within the next five years for pesticide programs, most to be in the Plant Industries Division.

State sources predict that 3,287 commercial applicators will require certification by October 21, 1977, as will approximately 50,000 private applicators. The number of commercial applicators is not expected to increase appreciably during the next five years. Skill levels will increase to a small degree, and demands will increase for degreed professionals with expertise in the field to serve as consultants.

No major changes are anticipated to occur in the operator training program. Agricultural curricula at the graduate and undergraduate level are chiefly carried out by the University of Tennessee.

IV. POTABLE WATER

The Tennessee Department of Public Health is responsible for the state's water supply regulatory program. State sources predict that Tennessee will accept primacy for the Federal Safe Drinking Water Act during 1977. While approximately 13 persons in the Department currently service the water supply program, significant staffing increases will be required to implement the Act. If sufficient funding is received, an estimated 40 persons will comprise the staff by 1982.

Operators in charge of water treatment systems must be certified. There are 1,143 certificates issued to operators, although the number of operators is approximately 800. Sources estimate that there are 50 laboratory workers, 50 maintenance workers, and 350-400 uncertified operators in the state. Increased requirements for all these personnel are projected for the next five years.

The Department offers an Operator Training School that offers upgrade and short courses to plant personnel. Officials propose to develop a comprehensive vocational program to meet the needs of all levels of plant and system personnel. In order to do so, significant increases in instructional personnel will be required however, state budget limitations could prevent the development of such a program.

Career opportunities should occur in the state agency for engineers and scientists. Demands for entry level and other operators should also increase.

V. RADIATION

The Tennessee Department of Public Health carries out the state's radiological health program as authorized by the Tennessee Radiological Health Service Act. The Department registers, licenses, inspects and monitors sources of radiation. The state currently contains several nuclear facilities.

The Department's Radiological Health Section employs eleven persons: ten radiological physicists and one chemist. According to officials, this staffing level should increase within several years to include six additional radiological physicists, one technologist and one secretary. The Oak Ridge National Laboratory employs five health physicists for radiation control functions. The Tennessee Valley Authority is constructing two reactors in the state and data indicate that within five years one health physicist and nine technicians will be employed at both of the plants for radiation control.

No new careers appear to be emerging within the radiation field in the state. State sources suggest that training available to staff is adequate and is continually improving through the efforts of the regional training committee formed by the Region IV Environmental Protection Agency. There is currently no certification program for health physicists in the state.

VI. SOLID WASTE

The Tennessee Department of Public Health implements the state's Solid Waste Disposal Act. Officials expect that during 1977 state hazardous waste legislation will be enacted that will comply with the Federal Resource Conservation and Recovery Act. The program is currently staffed with 20 persons: four engineers, one attorney, nine environmental consultants, two geologists, one technician and three clerical employees. To implement the hazardous materials program, preliminary estimates provide for the addition of at least nineteen personnel consisting of engineers, geologists and other scientists.

Sources estimate that there are approximately 214 persons in the state working in sanitary landfills, chiefly heavy equipment operators and weighmasters. There is one hazardous waste processing center in the state, which has three employees. Projections for the solid waste and hazardous materials operators are not yet available. The state agency does not plan to promote recovery systems because of costs and potential market problems.

Certification is not presently required for landfill operators in the State of Tennessee. The Department does conduct a training program for operators twice a year. The Department evaluates landfills on-site, and every landfill must have at least one registered operator to be in total compliance with the law.

VII. WASTEWATER

The Tennessee Department of Public Health implements the state's water quality program and anticipates accepting NPDES permitting authority in 1977 or 1978. While approximately 159 persons presently work in wastewater, chiefly engineers and scientists, an additional eight will be required to implement the new program: one attorney, engineers and scientists. No other increases are projected to occur during the next five-year period, due to legislative constraints.

Operators in charge of wastewater treatment plants and collection systems must be certified. There are currently 1,064 certificates that have been issued to operators, although the actual number of active certified operators is approximately 700. Sources estimate that there are 50 laboratory workers, 50 maintenance personnel and 600 uncertified operators in the state. An estimated 50 persons are employed by industries for wastewater and there are 20-30 consulting firms that service the field. The Tennessee Valley Authority also employs a significant number of persons for wastewater. The number of operators, laboratory personnel and maintenance workers is expected to increase about 8% annually and the number of persons in industries is expected to double. Increases will also occur in the Tennessee Valley Authority.

The Department conducts an Operator Training School which offers package plant schools, short courses and upgrade/improvement courses.

VIII. ENERGY

The Tennessee Energy Office is the state's lead energy agency. The Office advises the Governor on the general energy situation and develops measures to minimize the state's energy problems. Under the mandates of the Federal Energy Policy and Conservation Act, the Office is conducting training seminars to assist homeowners in reducing energy costs. Sixteen persons are employed in this office, consisting of administrators, energy management advisors, energy analysts, and energy analyst trainees. Officials indicate that there will be a growing need for conservationists and lawyers, although no specific projections could be made since new positions will be totally dependent upon the availability of funds.

A Governor's Advisory Committee was recently created which assists with the development of a State Energy Conservation Plan. The Committee has worked in conjunction with the Tennessee Energy Office and the University of Tennessee Environmental Center to prepare the proposal for submission to the Federal Energy Administration.

With the limited availability of information concerning energy programs, it is impractical to offer trends for career potentials in the energy conservation and conversion field. However, considering the growing energy shortage, it is reasonable to assume that while job opportunities are declining in traditional energy programs, there will be considerable demand for personnel with experience in nuclear energy.

STATE OF TENNESSEE - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR[1]	150	150	150	150	150	150	0%
NOISE[2]						7	n/a
PESTICIDES[3]	222	236	250	250	250	250	2%
POTABLE WATER[4]	1,613	1,777	1,937	2,089	2,245	2,400	8%
RADIATION[5]	16	23	31	40	47	47	25%
SOLID WASTE[6]	20	31	35	35	39	39	12%
WASTEWATER[7]	2,100	2,300	2,500	2,700	2,900	3,000	8%
ENERGY[8]	16						n/a
TOTALS	4,137	4,517	4,903	5,264	5,631	5,893	7%

[1] Includes the state and local agencies. Not included are an estimated 850 persons in other agencies and the private sector.

[2] The 1981 figure includes preliminary staffs for the state and Chattanooga-Hamilton County programs. Development of staffs in other agencies could also occur.

[3] Includes state and county personnel and does not include an estimated 3,287 commercial and 100,000 private applicators to be certified by October 21, 1977. Little future workforce growth is expected for applicators.

[4] Includes state personnel and estimates of all employees at the State's water treatment plants.

[5] Includes state personnel, TVA and the Oak Ridge National Laboratory.

[6] Includes the state agency personnel. Does not include the estimated 217 other persons in the state involved in solid and hazardous wastes excluding collection.

[7] The above estimates include the state agency, plant personnel, the private sector and TVA.

[8] The above includes the state lead energy agency. Projections are unavailable, although increasing demands may occur for attorneys and conservationists.

EDUCATION

There are several educational institutions in Tennessee which are designed to prepare students for employment in environmental fields in private industry and government. Chattanooga State Technical Community College offers an A.S. degree in Chemical and Environmental Technology. East Tennessee University provides B.S. and M.S.E.H. programs in Environmental Health as well as a Public Health Sanitation School and Certificate.

The University of Tennessee at Knoxville offers an environmental engineering curriculum on the B.S., M.S., and Ph.D. levels. Students at the University of Tennessee at Nashville may earn a B.S. or M.S. degree in Civil Engineering. Vanderbilt University offers two bachelor degrees, the B.Engr. in Environmental and Water Resources Engineering and the B.S. in Environmental Science. The former program is also offered on the M.S. and Ph.D. levels while the latter program may be continued on an M.S. level.

Austin Peay State University offers a B.S. degree in Environmental Science. The State Technical Institute at Memphis offers a two-year Environmental Technology program. A four-year curriculum in Environmental Science and Technology is offered at Middle Tennessee State University. Walters State Community College provides an A.S. program in Environmental Health Technology. Volunteer State Community College offers A.S. degrees in three options through the Department of Conservation and Environmental Technology.

LEGISLATION

The environmental/energy legislation for Tennessee was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Tennessee Air Quality Act

Pest Control Operators Act of 1972

Insecticide, Fungicide and Rodenticide Law

Public Water Supply and Sewer System Law

Radiological Health Services Act

Solid Waste Disposal Act

Public Water and Waste Water Environmental Health Act of 1971

Water Quality Control Act of 1971

Production of Oil and Gas Law

Surface Mining Law

National Environmental Energy Workforce Assessment

Phase I

TENNESSEE

State Report

STATE PROFILE

Tennessee is classified as an east south central state of the United States. The state's geography is unique in its extreme breadth of 432 miles, stretching from the Appalachian boundary to the east and the Mississippi River to the west; and its narrow width of 112 miles. Tennessee ranks 34th in the nation in land area and 17th in population. According to a 1970 census, the state held 3,923,687 persons during that year, approximately 59% of whom lived in urban areas.

Tennessee has a moderate climate with cool winters and warm summers. The state receives ample precipitation, about 50 inches a year, rather evenly distributed over seasons and regions. The growing season ranges from 160 days in the east to 260 days in the southwest. Approximately 52 percent of the state is forested.

The agricultural resources of the state have always been slim. Almost 70 percent of the land is unfit for cultivation, and less than two percent is classified as good. Until Tennessee's shift from agriculture to manufacturing began in the 1940's, these weak resources contributed to Tennessee's high underemployment rate, low income and educational levels, and substandard housing. Manufacturing gains have caused significant improvements in these conditions, and today Tennessee ranks among the top 20 states in value added by manufacture and in industrial employment. The major industries in value added by manufacture are chemicals, food processing, apparel, electrical machinery and textiles. The state has moderate coal and stone deposits, and is the nation's largest producer of zinc. Agriculture produces less than four percent of personal income.

The creation of the Tennessee Valley Authority by the United States Congress in 1933 enhanced Tennessee's transition to an industrial-based economy. The growing stock of electricity supplied by the Authority has attracted numerous major industrial enterprises.

During 1976, the state's industrial growth was impressive, with 180 firms investing approximately $500 million to build or expand plants. This created an estimated 16,000 new jobs during the year. At the end of 1976, the state's unemployment rate was about five percent below the national average. Mr. Tom Benson, Commissioner of Economic and Community Development, was recently quoted in the Atlanta Journal (January 9, 1977) as saying that the year 1977 may well be the greatest in terms of industrial growth in many years. This industrial expansion in the state has largely been attributed to the aggressive policy of the state government of enticing industry from other states.

TENNESSEE POLLUTION CONTROL AND ABATEMENT AGENCIES

The Tennessee Department of Public Health is the state's principal environmental agency. The Department has primary responsibility for the air, potable water, radiation, solid waste and wastewater programs. Tennessee does not currently have a statewide noise program, although if such a program is developed, it will most likely be located in the Department of Public Health. The Tennessee Department of Agriculture holds chief responsibilities for the implementation of the state's pesticide programs. The designated state energy lead energy agency is the Tennessee Energy Office.

The Department of Public Health's environmental programs are located in its Bureau of Environmental Health Services. This Bureau has four divisions: the Air Pollution Control Division, Occupational and Radiological Health Division, the Solid Waste Management Division and the Water Quality Control Division.

The Air Pollution Control Division monitors and assures healthful air quality in the state in cooperation with the four major metropolitan air quality regulatory agencies (in Knox, Hamilton, Davidson and Shelby Counties). The Division's purpose is to control air pollution to a safe and acceptable level, and it regulates air pollution from all sources, both public and private.

The Occupational and Radiological Division is in charge of regulating safe and healthful working conditions within work areas, and controls the use, handling, and disposition of radioactive materials and machines. The Divison also conducts analyses of milk, air and water samples collected throughout the state to test radiation levels.

Radioactivity levels are monitored continuously at fixed sites, and special off-site air and water monitoring is performed in the vicinity of all nuclear facilities.

Assuring that solid waste materials generated within the state by municipalities and industries are processed and disposed of in an environmentally sound manner is carried out by the Solid Waste Management Division. Activities include the approval of sites for sanitary landfills, approval of plants for operation of landfills, approval and administration of solid waste management grant funds, and approval and administration of Tennessee's Resource Recovery Loan Act.

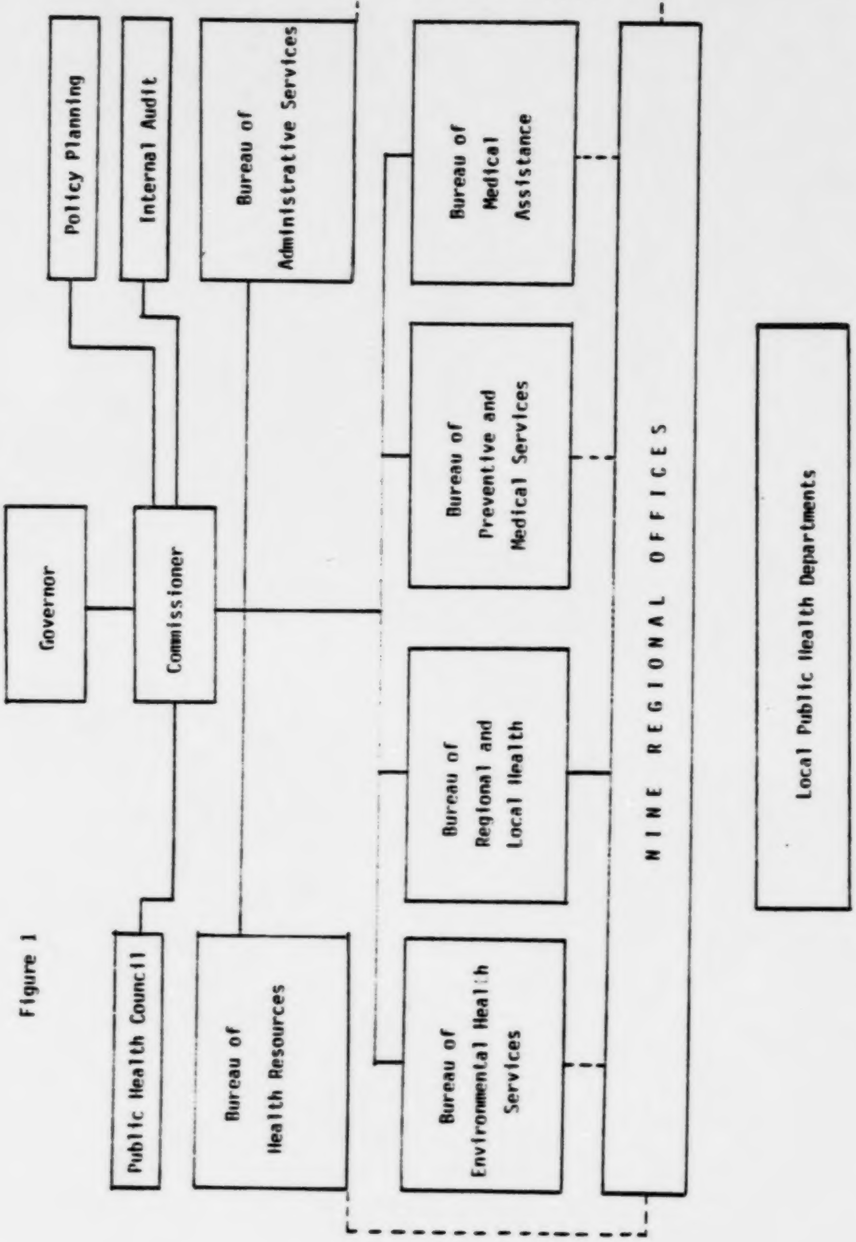
The Water Quality Control Division is responsible for assuring high quality of drinking water and wastewater discharged into streams of the state. This Division regulates water quality from all water discharges, public and private, and its chief purpose is to assist in the development and maintenance of adequate drinking water supplies and wastewater systems within Tennessee so that they may be safe for drinking, recreation, industry, and other uses.

The Plant Industries Division of the Tennessee Department of Agriculture is responsible for the registration of pesticides, for the licensing of pesticide dealers, and has been designated as the lead agency for the administration of the Pesticide Applicator Certification Program. In addition, laboratories of the Department's Food and Drug Division analyze pesticides to determine if these products meet their labeled guarantees, and analyze food and other samples for determining pesticide content. The Tennessee Cooperative Extension Service is responsible for conducting a comprehensive training program for commercial and private pesticide applicators.

The Tennessee Energy Office was established in 1974 to advise the Governor and the Tennessee Legislature on the general energy situation and to develop measures to minimize the state's energy problems. The Office has two main programs: Data Collection and Conservation. The principal function of the Data Collection Program is to conduct research in pertinent disciplines. The activities of the Conservation Program are directly related to the mandates of the Federal Energy Policy and Conservation Act.

Figure 1

TENNESSEE DEPARTMENT OF PUBLIC HEALTH


Governor
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Internal Audit
Public Health Council
Bureau of Administrative Services
Bureau of Health Resources
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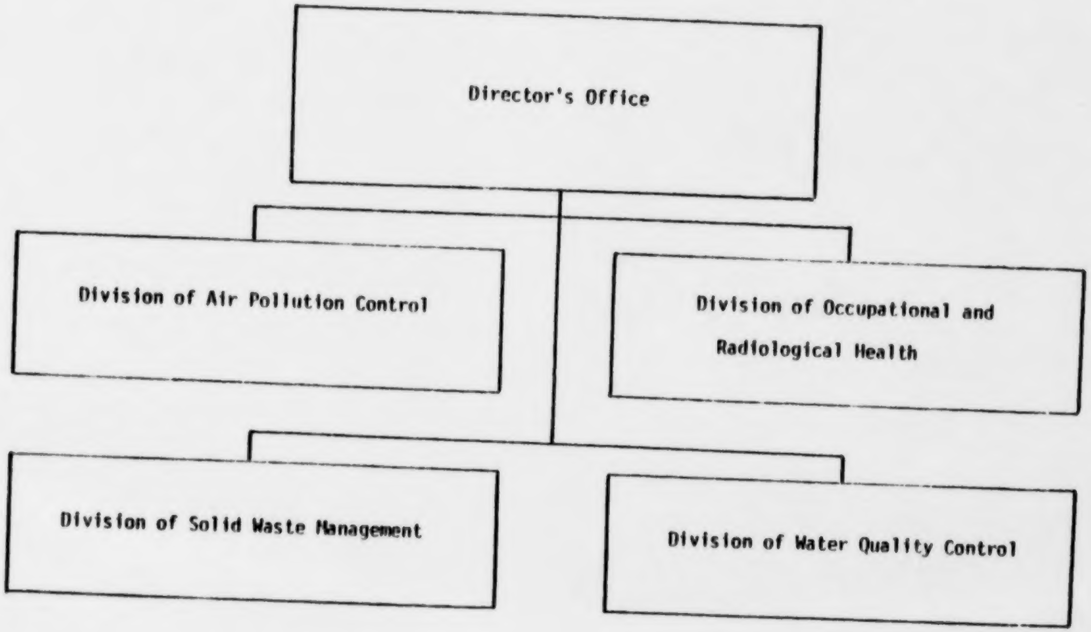
Bureau of Preventive and Medical Services
Bureau of Regional and Local Health
Bureau of Environmental Health Services
N I N E R E G I O N A L O F F I C E S
Local Public Health Departments

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Bureau of Environmental Health Services

Figure 2


Director's Office
Division of Air Pollution Control
Division of Occupational and Radiological Health
Division of Solid Waste Management
Division of Water Quality Control

Pollution Control and Abatement Programs

I. AIR

A. Introduction

The Tennessee Air Quality Act, which was adopted in 1967, created the Tennessee Air Pollution Control Board. The Board is empowered to adopt regulations, initiate court action to enforce the regulations, require installation of central equipment, and to hold hearings to obtain compliance. The Director of the Air Pollution Control Division, the state air pollution control lead agency, serves as Technical Secretary of the Air Pollution Control Board.

The Air Pollution Control Division, which is located in the Tennessee Bureau of Environmental Health Services, has the following responsibility: to maintain the purity of the air resources of the State of Tennessee consistent with protecting normal health, general welfare, and physical property of the people while preserving maximum employment and full industrial development of the State.

Knox, Hamilton, Davidson, and Shelby Counties are authorized to administer local air programs. The topography of Hamilton County often creates major temperature inversions which contribute to particulate problems.

There are 506 major sources located in Tennessee. Within Region IV, Tennessee ranks fourth in the number of major sources. Of the 506 sources, only 15 remain in violation of the emission levels and/or compliance schedules.

B. Workforce Profile

The Division of Air Pollution Control has four major program areas: Engineering, Enforcement, Technical Services, and Administration. Supportive services are provided to the central Nashville office by six regional offices located in Johnson City, Knoxville, Chattanooga, Columbia, Jackson, and Cookeville. The cumulative staffing level of the central and regional offices is 90 persons: 73 professional and 17 administrative/clerical positions. The following table illustrates the distribution of the staff by occupational type.

TABLE I

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Bureau of Environmental Health Services
Division of Air Pollution Control
Current (1976) Staffing Level

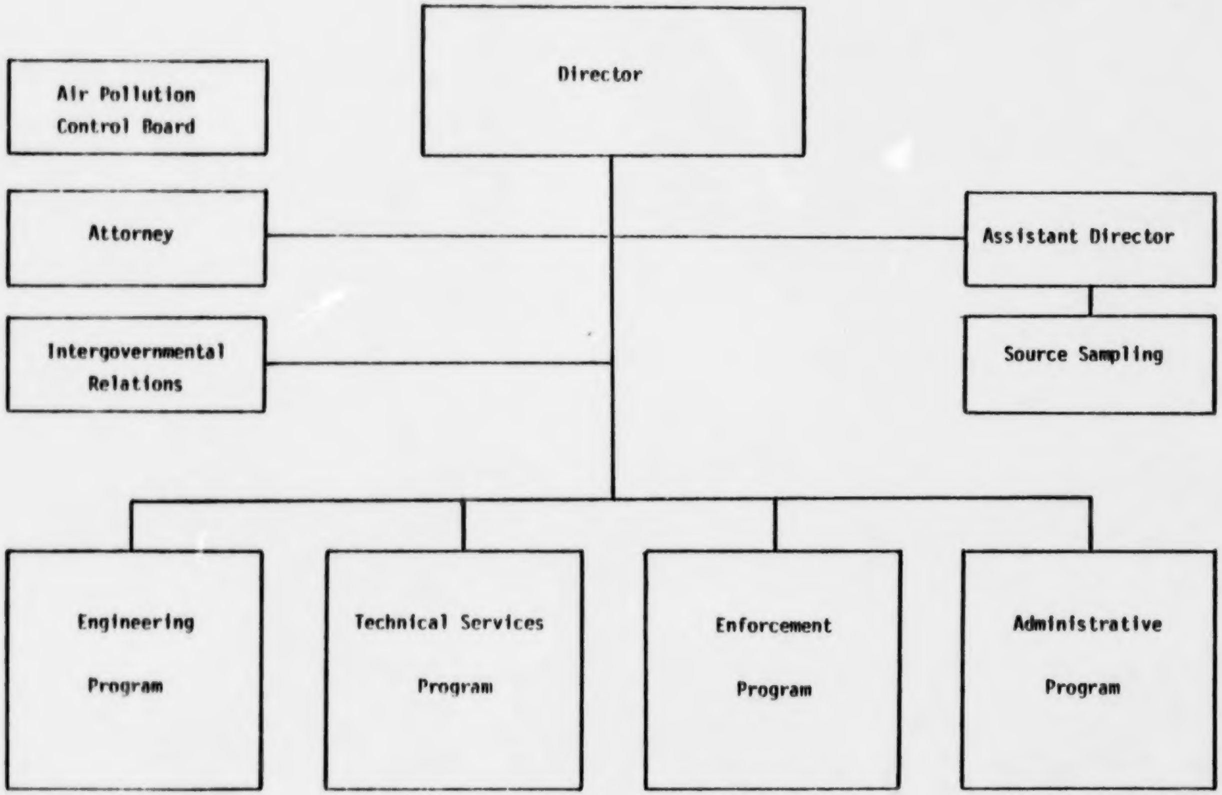
Position	1976
Engineer	17
Attorney	1
Meteorologist	2
Research Scientist	31
Technician	20
Other	19
TOTAL	90

The Other category consists of the division director, the assistant director, a health administrator, an information representative, and twelve clerical positions.

There has been minimal change in the staffing level of the Division during the last two years. The greatest increase in the Division's total staffing level occurred between 2972 and 2973 when the department grew from 57 positions to 88 full-time staff members.

TENNESSEE DEPARTMENT OF PUBLIC HEALTH
Environmental Health Services Bureau
Division of Air Pollution Control

Figure 3


Director
Air Pollution Control Board
Attorney
Assistant Director
Intergovernmental Relations
Source Sampling
Engineering Program
Technical Services Program
Enforcement Program
Administrative Program

Four counties also administer local air pollution control programs: Knox, Hamilton, Davidson, and Shelby counties. The Knox program employs 11 staff members, Hamilton, 22, Davidson, 13, and Shelby, 13. The following table depicts the cumulative staffing of the local air pollution programs by occupational type, in person-years.

TABLE II

STATE OF TENNESSEE

Municipal Air Pollution Control Programs
Current (1976) Staffing Level

Position	1976 **
Engineer	12.5
Attorney	1
Scientist	14
Technician	10.5
Other*	21.5
TOTAL	59.5

*Includes administrative and clerical personnel
**Person-Years

Available information indicates that there are approximately 850 person-years in Tennessee employed in air pollution control positions in other governmental agencies and private industry.

C. Workforce Projections

Growth within the Division of Air Pollution Control during the next five years will be minimal. No expansion of program services is currently being considered. Staffing projections as estimated by the Division are depicted on the following table.

TABLE III

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Bureau of Environmental Health Services
Division of Air Pollution Control
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	17	17	17	17	17	17	n/a	0%
Attorney	1	1	1	1	1	1	n/a	0%
Meteorologist	2	2	2	2	2	2	n/a	0%
Scientist	31	31	31	31	31	31	n/a	0%
Technician	20	20	20	20	20	20	n/a	0%
Other	19	19	19	19	19	19	n/a	0%
TOTAL	90	90	90	90	90	90	10%	0%

Turnover within the Division is highest in the Technician category due to the low pay level, according to sources.

The State's four local air pollution control programs do not anticipate growing in staffing complements by 1982. However, the Nashville air program may increase in staff if the program acquires responsibility for enforcing motor vehicle inspection/maintenance regulations.

D. Training and Certification

The Division of Air Pollution Control actively encourages its staff to participate in continuing education programming. The Division frequently sends staff members to courses offered through the University of Tennessee. The University offers science and engineering programs which provide a sound background for on-the-job skill requirements.

The Division also encourages attendence at chemistry and science related programs offered through regional colleges. The science courses attended by the Division are chemistry oriented. These courses have proven helpful for enforcement and technical personnel; the courses have aided staff members in identifying new hazardous contaminants that are known to be toxic.

It is notable that state officials have indicated that professional and technical courses currently offered through state colleges and universities are inadequate to satisfy the training needs in air pollution enforcement, source sampling, visible emission, and meteorology.

Another source of valuable training in air pollution control has been the EPA Air Pollution Training Institute courses. The participants have generally rated the courses highly; however, the courses are considered to be expensive, not readily accessible, and sometimes overly technical. According to a report by the Air Pollution Training Insititute, ten persons from Tennessee attended training courses during Fiscal Year 1976.

The Division of Air Pollution Control administers a Visible Emission Certification and Training Program. The certification program is offered six times a year in Nashville. In Fiscal Year 1976, a total of 195 persons were trained and certified through this program. The Division certified smoke readers for the Tennessee Valley Authority, private industry, the four metropolitan air agencies, and the state staff. The initial certification is three days, the recertification two days. Tuition is charged for the class.

E. Career Potential

Career prospects within the air pollution control and abatement field appear to have stabilized. From the available information, it would appear that there will be limited growth in the Division of Air

Pollution Control during the next five years. All projections were made on the basis that growth rates were estimated with regard to existing program functions; however, if federal legislation were passed which would impact the operation of the division, and if funding were available, these projections would necessarily be altered to meet the expanded program requirements.

F. Conclusion

The career potential for all occupations within the air pollution control fields in the State of Tennessee is reasonably stable. However, even though the workforce requirements for personnel have stabilized as compared to the last five years, there will be a continuing demand for qualified personnel at all levels within the air pollution control field. In addition, it is important to note that technically oriented training programs for professionals and technicians are relatively scarce.

II. NOISE

A. Introduction

Tennessee has not enacted noise legislation on a statewide basis. The State Legislature commissioned a joint committee study concerning noise pollution, and the Commissioner of Public Health was designated to supervise this study. The Division's Technical Services Branch reviews citizen complaints but, without legislative authority, is unable to take any substantive action. This Division has requested funds from the Tennessee Legislature for answering noise complaints, but has not received the requested assistance. State sources are hopeful that the study committee's recommendations will include proposals for state noise restrictions, and that a noise abatement program will be created within the next few years.

B. Workforce Profile

A number of noise control programs have been initiated at the local level. According to the director of the Pollution Control Division, a part of the Metropolitan Health Department of Nashville and Davidson County, this Division employs one environmentalist who spends twenty-five percent of his time performing noise level measurements in Davidson County, but they have lain inactive for one year, as the Pollution Control Division has no regulations for enforcement. In Memphis, the police department has authority to enforce nuisance and vehicle regulations, but no acoustical criteria are included in these regulations. The Chattanooga-Hamilton County Air Pollution Control Bureau recently completed a noise survey and takes citizen complaints concerning noise pollution problems; the Bureau has no noise regulations to enforce. This Bureau plans to add a noise component to its program once regulations including acoustical criteria are enacted in the county.

Five cities in Tennessee have some type of municipal noise control ordinance. The December, 1976, issue of Sound and Vibration listed the types of ordinances these cities have in an article entitled "Municipal Noise Ordinances-1976", by Clifford R. Bragdon, contributing editor. The noise ordinances, as set forth in the article, are depicted in the following table.

TABLE IV

STATE OF TENNESSEE

Municipal Noise Ordinances (1976)

City	Nuisance	Zoning	Vehicle	Rec/ Vehicle	Railroad	Aircraft	Construction	Building
Chattanooga	0	-	0	-	-	-	0	-
Kingsport	0	-	0	-	0	-	-	-
Knoxville	-	-	X	X	-	-	0	-
Memphis	0	-	0	-	-	-	0	-
Nashville	-	X	0	-	-	-	-	-

Key: X Regulations including acoustical criteria
0 Regulations not including acoustical criteria
- No regulations

C. Workforce Projections

State officials hope that the legislature's joint study committee will recommend the implementation of a state noise control program. Officials of the Division of Air Pollution Control feel that this agency would be the most likely state agency to implement a state noise control program.

According to Mr. Wayne Scharber, assistant director of the Bureau of Environmental Health Services, if a noise bill were enacted by the Tennessee Legislature, $56,000 would be requested for the first year to identify major noise sources and to develop regulations; he projected that a state noise control program would be integrated with the Division of Air Pollution Control. Although the first year's operations would only necessitate the hiring of three or four persons, the program would further expand once the regulations were promulgated and the program actually implemented.

The Chattanooga-Hamilton County Air Pollution Control Bureau plans to add a noise control component to its enforcement activities. The component will be located within the Air Quality Section, and will initially include an investigator, a technician and a secretary.

D. Training and Certification

The University of Tennessee's Department of Otolorynology and Maxilofacial Survey recently conducted a course entitled "Audiometric Orientation for Hearing Conservationists in Industry". The course was held January 26-28, 1977, and its purpose was to aid industry in understanding noise problems and their impact on hearing. Another goal was to teach plant nurses and safety personnel to begin pre-employment and ongoing hearing tests and to initiate industrial hearing conservation programs. Participants of the course could later apply to the Council for Accreditation of Occupational Health Conservationists for recognition as "Occupational Hearing Conservationists". This university has on staff Dr. David M. Lipscomb, Professor of Audiology and Speech Pathology, who has special expertise in the area of noise and its effects on animals and humans. Dr. Lipscomb is the director of the University of Tennessee's Noise Research Laboratory.

E. Career Potential

No new career types are anticipated by state sources other than for technician type positions, which involve routine sound monitoring and testing. If the state does create a noise program and promulgates regulations to provide for enforcement, the career potential in the noise field will markedly improve. Chattanooga-Hamilton County also require additional noise technicians, as a noise control program is planned for implementation within the next two years.

F. Conclusion

Tennessee does not currently have a statewide noise program, as there are no statewide regulations requiring the abatement of noise. A strong chance exists that a statewide noise program will be adopted within several years. Five cities have some type of municipal noise ordinance, and it is likely that more cities will enact stronger noise control regulations with acoustical criteria once a statewide program is established. State sources regard the noise pollution abatement field as a relatively new program area and will rely upon the impetus and support of the Environmental Protection Agency for the development of a comprehensive program.

III. PESTICIDES

A. Introduction

The Plant Industries Division of the Tennessee Department of Agriculture holds chief responsibilities for the implementation of Tennessee's pesticide programs. The Division is responsible for the registration of pesticides, for the licensing of pesticide dealers, and has been designated as the lead agency for the administration of the Pesticide Applicator Certification Program. Also carried out in the Division are other agricultural duties not directly related to pesticide control.

Legal authority for the State's pesticide program is contained in three laws. The Tennessee Insecticide, Fungicide and Rodenticide Law requires that restricted use pesticides be registered with the Department of Agriculture, and regulates their sale and distribution. The law also requires that all pesticide dealers be licensed annually by the Department. The Tennessee Pest Control Operators Act of 1975 creates a Pest Control Board and requires that those engaged in the business of pest control be licensed or chartered by the Department, while business agents or solicitors must be registered. Each person applying for or holding a charter must have for each office a licensed certified applicator of the required class for each category of service offered. The Tennessee Commercial Aerial Applicators Act of 1974 requires that commercial aerial applicators of pesticides be licensed by the Department.

Tennessee's State Plan for Certification of Pesticide Applicators was submitted to the Environmental Protection Agency for approval on a contingency basis. Approval is to be contingent upon promulgation of additional regulations.

The Tennessee Pest Control Licensing and Advisory Board, created by the Pest Control Operators Act, consists of seven members, as follows: the Commissioner of Agriculture, the Director of Entomology, a member of the staff of a university in the State, two licensed pest control operators, and two Tennessee citizens who are not associated with the pest control industry. This Board meets quarterly, examines and certifies applicants for licenses, and advises the Department concerning the regulation of pest control operators.

The Tennessee Cooperative Extension Service is responsible for conducting a comprehensive training program for commercial and private applicators. In addition, laboratories of the Food and Drug Division of the Department of Agriculture analyze pesticides to determine if these products meet their labeled guarantees and analyze foods and other samples for determining pesticide content.

The Cooperative Extension Service carries out an ongoing cotton scouting program which is supported by federal funds. Between June and September, persons are hired to assist those farmers that request the service in identifying insects and determining economic threshold for pesticide application.

B. Workforce Profile

Within the Plant Industries Division are eleven permanent positions for pesticides, and four temporary positions. The permanent positions include the head of the pesticide control program, five pest control inspectors, one supervisor, one chemist and three secretaries. The pest control inspectors inspect properties, perform audits and investigations, and enforce pesticide laws and regulations. These persons have at least bachelor-level degrees in such fields as botany and agronomy, and have strong backgrounds in biology and chemistry. Temporary employees also have college degrees in a variety of fields which are funded under the Comprehensive Employment and Training Act.

Because additional workforce is required, but funds are not available, the pesticide program has been utilizing approximately six person-years of time from other programs in the Department. Those persons utilized are chiefly entomologists and plant pathologists, who perform field functions similar to those of the pest control inspectors.

Within the Food and Drug Division of the Department, three chemists perform pesticide-related analytical services. Two of these chemists perform pesticide residue analyses, while one analyzes pesticides for label accuracy.

Ten Extension Specialists in the Tennessee Cooperative Extension Service have prepared and conducted training sessions for commercial pest control operators. These persons come from various backgrounds, such as entomology, engineering, wildlife management, forestry and nematology. These Extension Specialists have provided training to 94 extension leaders throughout the State, and approximately the same number of assistants, who in turn offer private applicator training.

The commercial applicator categories utilized by the Division are the suggested federal categories, although additional subcategories are utilized. The categories, subcategories and estimated number of applicators requiring certification, as stated in the State's Certification Plan are as follows:

Category	Number
Plant Agriculture	855
Consulting Entomologist	2
Aerial Applicator	50
Weed-Agriculture	30
Agriculture-Ground	35

Fumigation-Agriculture	5
Fumigation-Non-restricted	5
Animal Agriculture	10
Consulting entomologist	3
Forest Pest Control	6
Consulting Entomologist	2
Aerial applicator	5
Ornamental and Turf	615
Consulting Entomologist	1
Horticulture	30
Lawn and Turf Management	15
Seed Treatment	45
Aquatic Pest Control	15
Consulting Entomologist	1
Aerial Applicator	2
Right-of-Way	
Aerial Application Herbicide	12
Weed Right-of-Way & Industrial	18
Industrial, Institutional, Structural and Health-Related	
Wood Destroying Organisms	365
General Pest Control & Rodent Control (Household & Commercial)	200
General Pest Control & Rodent Control (Non-restricted)	100
Bird Control	25
Fumigation (Non-restricted)	12
Fumigation (Structural & Commercial)	24
Weed Control (Right of Way and Industrial)	18
Consulting Entomologist	6
Public Health	232
Regulatory	68
Demonstration and Research	475
TOTAL	3287

The numbers of categorized applicators were arrived at by the Division through research of various available compilations of industries and governmental agencies and also with anticipated additions. Dealers of restricted pesticides, who must also be certified, are included in the plant agriculture category.

The Tennessee laws establish two categories of commerical applicators: a licensed certified commercial category and non-licensed commercial applicator category. The persons who are non-licensed certified commercial applicators (including but not limited to officials or employees of State, federal or local governments) may not apply pesticides for a fee.

The Plant Industries Division estimates that 100,000 farmers will require certification. This number may vary according to the final form of the Federal restricted-use pesticide classification.

The total estimated pesticide and pest control picture is reflected in the following table, in which figures are approximations of the workforce engaged in pesticides activities on either a full- or part-time basis:

TABLE V

Current (1976) Tennessee Pesticide Workforce Staffing Levels for both the Public and the Private Sectors (est.)

Public Sector	1976
Department of Agriculture:	
Plant Industries Division	21
Food and Drug Division	3
Cooperative Extension Service	198
Total	222
Private Sector	
Farmers	100,000
Owners/Operators/Applicators	3,287
TOTAL	103,287

C. Workforce Projections

During 1977, the Plant Industries Division hopes to obtain an additional chemist for monitoring activities, and a secretary. Also hopefully within the next one or two years the six person-years of effort from other programs will be converted to pesticide staff positions. Unless federal requirements are reduced, an additional fifteen to twenty percent increase in staffing level will be required by 1982. According to these projections, the Plant Industries Division should have 27 to 28 full time positions within five years. Turnover is estimated to be less than 5% per annum.

Officials in the Food and Drug Division estimate that one more chemist may be required within the next five years for performing pesticide residue analyses. Additional workforce needs are not expected in the Cooperative Extension Service for pesticides training, according to sources. Activities should decrease after the certification deadline date in October of 1977, but should again increase in five years, when recertification of applicators will be required.

According to professionals in the Plant Industries Division, the number of commercial applicators is not expected to increase appreciably during the next five years. Growth has been rapid in recent years to the point that the market has become quite saturated. For the most part, the make-up of the profession is also not expected to alter. Skill levels will increase to a degree, due to the increased numbers requiring certification in the State. As chemicals become more complex and requirements more stringent, increased demands may occur for degreed professionals with expertise in the pesticides and pest control field to serve in a consultant capacity for private enterprise.

D. Training and Certification

On-the-job training is offered to personnel of the Plant Industries Division as required both in the form of informal seminars and on a one-on-one basis. Other technical training opportunities are available to personnel, both in and out of the State. Every professional has been offered the certification training carried out by the Cooperative Extension Service and many have attended conferences and courses offered by such sources as the University of Tennessee, Memphis State University, and the Association of Agricultural Chemists. Trade industries and other colleges occasionally offer related courses.

Training for commercial applicators is held in three localities in the State. General Standards training is based upon the EPA Core Manual, and lasts from two to four hours depending upon the applicator category. Specific category training also varies from two to four hours in length. Sessions for each category will be held at least once at each of the three locations before October of 1977. Slide presentations and lectures are the principal mode of material presentation. Although recertification will be required every five years, commercial applicator training will be offered continuously for those requiring initial certification. The Extension Service may hold sessions at rates depending upon the needs, or may provide the necessary materials to applicators for self-study. Examinations will continue to be administered by the Plant Industries Division.

Training sessions for private applicators last two to four hours, and the EPA core manual is used as the basis for instruction. The number of sessions held in each county depends upon the number of farmers requiring certification, and training is offered between January and April, and between August and September. Slides and lectures are also used for private applicator training. Certification is made on the basis of satisfactory completion of training, or, at the applicants' option, through examination without training on the material in the core manual. Testing is supervised by the Plant Industries Division. For non-readers, oral testing is relied upon, although training is largely the same for these applicants. In these cases certification is limited to the pesticide or pesticides for which the applicant is able to demonstrate competency, and special guidance by county extension leaders is provided when necessary. Training in the future is not expected to change appreciably from its present structure.

E. Career Potential

At the State level, limited opportunities may occur for degreed persons with agricultural, biological and chemical backgrounds. Opportunities may also be available for pesticide applicators, largely as a result of turnover, as overall workforce growth is not expected to occur. Demands should increase in the private sector, however, for professionals with high levels of expertise in the fields of pesticides and pest control to serve in consulting capacities.

F. Conclusion

The Plant Industries Division of the Tennessee Department of Agriculture is the principle pesticide regulatory agency in the State. Custom applicators, or those performing services for a fee, have been regulated by the Division for 20 years, but the program has been greatly expanded to meet federal requirements. This Division has not been able to staff up to the required level as yet to carry out required services due to State budget limitations. The needed additions should be made within several years.

The number of certified applicators is not expected to increase appreciabl , and State sources do not indicate that the field will be dramatically upgraded though these sources would find such a phenomenon desirable. The chief reason that the make-up or level of expertise is not expected to alter is that applicators would probably not be willing to invest the time and money to attend training beyond that required for certification.

Opportunities in the field appear to be best for degreed persons with a high level of expertise in pesticides and pest control. Demands for this type of person should increase in both the public and the private sectors.

Applicator training is carried out by the Cooperative Extension Service, and no major program changes have been developed. Agricultural curricula at the undergraduate and graduate level are chiefly carried out by the University of Tennessee.

IV. POTABLE WATER

A. Introduction

Tennessee Code Annotated Sections 53-2001 to 53-2008 authorize the Tennessee Department of Public Health to carry out the state's water supply program. The Department is authorized by the Act to exercise general supervision over the construction, operation and maintenance of public water supply and public sewerage systems throughout the state. The Act forbids that any person install or maintain any cross-connection, auxiliary intake, by-pass or interconnection unless the source and quality of water from the auxiliary intake, the method of connection, and the use and operation of the system has been approved by the department. When investigations find that a public water supply or sewage system is an actual or potential menace to health, the department may issue an order for the correction of the problem with a time limit for compliance.

This Act has been in existence for 20 years, and revision will be required in order for the state to assume primacy for the federal Safe Drinking Water Act (SDWA). An amendment to the Act has been under consideration by the 1977 General Assembly, and officials in the Department of Public Health believe that an amended bill will pass during this legislative session, and that primacy will be assumed sometime during 1977.

The Public Water and Wastewater Environmental Health Act of 1971 classifies water treatment plants and distribution systems into four groups, I through IV, according to the population served, type of treatment plant, and the complexity of treatment required for a particular water. Persons in direct responsible charge of water treatment plants and distribution systems must become certified under the provisions of the Act. A certification board is created by the Act to advise and assist the Department of Public Health in the administration of the certification program. The board is charged with the responsibility of conducting all work necessary to promote the program and maintain records, and to adopt rules and regulations required in performing its obligations. The board is composed of the following:

1) Two members who are currently employed as water or wastewater operators holding valid certificates;
2) One member to represent the municipalities of Tennessee;
3) One member who is a faculty member of a college, university or state technical institute, whose major field is related to sanitary engineering;
4) One ex-officio member representing the Tennessee Department of Public Health.

Previous to the passage of the Federal Act, there were 580 water treatment plants identified in the state. New federal definitions increased the number of designated public water systems in the state to approximately 2,500. The newly designated systems are very small, and generally require only part-time operators.

B. Workforce Profile

Functions relating to potable water are carried out in the Division of Water Quality Control of the Department of Health's Environmental Health Services Bureau. The division is made up of eight main sections and four basin offices. The components and approximate percentages of time devoted to potable water, as opposed to wastewater are listed below:

Component	% For Potable Water
Administrative Section	10%
Enforcement Section	10%
Program Planning	10%
Basin Planning Section	10%
Laboratory Section	10%
Operator Training	50%
Drinking Water Section	100%
Wastewater Section	0%
Basin Offices (Knoxville, Chattanooga, Nashville, Jackson)	15%

Among the duties and responsibilities carried out in the division for potable water are the following;

1) The review of plans for public water supply systems;
2) Monitoring operating systems and providing technical assistance as required;
3) Coordinating loans for the construction and upgrade of facilities;
4) Carrying out analyses of drinking water samples and certifying laboratories; and,
5) Training operators of water treatment plants and distribution systems.

As of October, 1976, there were 172 persons working within the Division of Water Quality Control. Eight of these persons were in the Drinking Water Section, as follows: one health administrator, six engineers, and one secretary. In the remaining divisions, an estimated five person-years of effort were contributed toward potable water. This would include input from such personnel as chemists, biologists, engineers, instructors, attorneys and secretaries.

Engineers come chiefly from sanitary and civil engineering backgrounds. Water quality specialists are degreed persons, mainly in the areas of biology and chemistry, yet this position pays less than the position classifications of biologist and chemist. For filling instructor positions, administrators search for persons with degrees in a related field and experience in operating water and/or wastewater treatment plants. All positions are filled through the State Civil Service Board. Qualified engineers are often not listed on the Board's register, in which case the Division initiates recruitment through universities.

The following table depicts approximations of workforce levels in the Division of Water Quality Control devoted to potable water, based on imput from administrators. Figures are depicted in person-years.

TABLE VI

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Potable Water Program Operations
Current (1976) Staffing Level (est.)

Position	1976
Engineer	7
Scientist	2
Trainer	2
Other*	2
TOTAL	13

*Includes an administrator and secretary

Operators in direct charge of water treatment plants must be certified at the level of the plant operated, or at a higher level. All other operators are encouraged to become certified. In a small system, or in a water distribution system, a single person may become the certified operator for more than one function. To become certified, persons must fulfill all specified requirements including the passage of a written examination. A certificate indicates that portion of the plant or system for which a person is qualified to operate. Grade I operators must have at least one year of experience in a Group I plant and pass the required written examination. Increasing amounts of education and operating experience are required for being qualified for certification at higher levels. The requirements for distribution system operators are basically the same as those for treatment plant operators, except that like experience requirements are for the distribution system in the group under consideration, instead of the treatment works.

Records of the Department of Public Health indicate that there are currently 1,143 certificates issued for water supply operations. The actual number of operators, however, is approximately 800, as many operators hold certificates in two or more categories. The department has provided the following breakdown of certificates:

TABLE VII

STATE OF TENNESSEE

Current (1976) Number of Certificates Issued

Category	1976
Chemical Control (Classifications 1, II)	146
Bacteriological Control (one classification)	16
Filtration (Classification II-IV	539
Distribution (Classification I-III	442
TOTAL	1,143

Only the very large treatment plants employ full-time laboratory workers and full-time maintenance workers. State sources estimate that approximately 50 of each type of personnel are employed in water treatment plants in the state. In the remaining plants, operators perform the required functions. Field research indicates that there are from 350 to 400 uncertified operators in the state, for a total of approximately 1,600 persons working in water treatment plants.

C. Workforce Projections

Federal funds have provided for the addition of approximately 12 potable water personnel, to be distributed to the Division's district offices during 1977. These additional personnel include: six engineers, one chemist, two water quality specialists, one health administrator and two secretaries. During 1977, these positions will be necessary for program development in preparation for assumption of primacy for the Safe Drinking Water Act.

To actually implement the federal Act, additional personnel will be required by 1982, mostly engineers. Unless state budget limitations are eased, these positions may not be obtained.

The turnover rate is highest for engineers because of the high demand for these professionals throughout the public and private sectors. The supply of chemists and biologists is presently greater than the demand, and these positions are most easily filled.

The following table depicts workforce projections to 1982 for potable water according to estimates by professionals in the field. Levels could vary with the amount of funds available and responsibilities imposed as a result of accepting primacy.

TABLE VIII
TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Potable Water Program Operations
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%annum turnover (average)	%annum growth (average)
Engineer	7	13	15	17	19	21	10%	27%
Scientist	2	5	7	8	9	10	5%	46%
Other	4	7	8	8	9	9	5%	20%
TOTAL	13	25	30	33	37	40		28%

Using staffing guidelines similar to those developed by the U.S. Environmental Protection Agency (EPA) for wastewater treatment plants, State officials have determined that to properly staff the systems in the State, 1,554 water treatment plant operators are needed, and 777 persons are needed to staff the distribution systems. These sources believe that the plants will be staffed to this estimated required level within five years. It should be noted that these figures do not take into account the possible ramifications of the Safe Drinking Water Act.

The following table depicts staffing requirements, as developed by the Tennessee Department of Public Health for water treatment facilities throughout the State. The guidelines for recommended staffing for water plants were set at 80% of those found in EPA's guidelines for wastewater treatment plants using activated sludge as a treatment process.

Treatment Plants: Size (MGD)	No.	Total Workforce Required
≤ 1	447	894
2	39	234
3	13	91
5	8	64
7	3	27
10	3	42
20	4	64
42	1	34
58	1	46
72	1	58
TOTAL		1,554

State officials found no hard data on staffing requirements for distributions systems, but found that the average was about half the number found in the treatment plants. Using this assumption, it was determined that 777 personnel are needed to properly staff the state's distribution systems.

With the new definitions and requirements of the Safe Drinking Water Act, an even greater number of operators will be required. The number of new systems is approximately 1,980, which because of their small size will not require the presence of a full-time operator. An estimated 660 additional operators are projected, under the assumption that one person will be able to operate three water treatment and distribution systems.

The number of laboratory workers and maintenance personnel in water treatment plants is expected to grow at a rate similar to the projected growth rate of operators of larger treatment plants. Based upon the available information, the following table depicts workforce projections to 1982 for operators (certified and uncertified) of water treatment plants and distribution systems, and for laboratory and maintenance personnel:

TABLE IX

STATE OF TENNESSEE

Private Sector Water Treatment Plant Operators
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%annum growth (average)
Operator	1,500	1,642	1,784	1,926	2,068	2,210	8%
Chemist/Lab Technician	50	55	60	65	70	75	8%
Maintenance	50	55	60	65	70	75	8%
TOTAL	1,600	1,752	1,904	2,056	2,208	2,360	8%

Most uncertified people are semi-skilled, and exhibit a high turnover rate. The average length of stay in the field for these persons is two to three years. If these persons become certified within this time frame, they are apt to stay in the field indefinitely. Since the implementation of the mandatory certification law in 1971, the average operator turnover rate has dropped, and the average operator age has dropped by fifteen to twenty years.

D. Training and Certification

Nearly every new entrant to the Division of Water Quality Control receives informal on-the-job training, under the supervision of a senior staff member for six to twelve months. Upgrade-type training is also offered to all professionals in the Division. Short courses are available through EPA at Athens, Georgia (Region IV EPA) or Cincinnati, Ohio, and through universities and the Division's Operator Training Center in Murfreesboro. Employees are also encouraged to attend night school courses in related fields, for which the Division will pay tuition fees. Two to three persons per year are able to attend school for attaining master's degrees, also funded by the Division. Finally, basic management courses are offered at the University of Tennessee, in which many Division employees participate.

In the State Operator Training School, special on-the-job training must be offered to new instructors as persons with the desired qualifications are difficult to find. New entrants spend two weeks working in a water treatment plant and the same amount of time in a wastewater treatment plant. Instructors also participate in technical upgrade training courses.

Although the Operator Training Section of the Division has been in existence since 1971, the Tennessee State Operator Training School was built in 1973. The facility was built largely due to the impetus and support of the Tennessee Water and Wastewater Association. State funds supported the construction of the facility, and equipment was added with Federal funds, under

P.L. 92-500. Four of the six instructors are supported through two Federal grants. Two types of water supply training are offered.

1) Two and Three-Day Courses: Three times per year these courses are offered for water and wastewater treatment plant personnel in local community colleges and universities. These are designed to meet recertification requirements. Approximately 300 operators participated during Fiscal Year 1976 (water and wastewater).

2) Upgrade and Improvement Courses: Eighteen courses are offered at the training facility that vary in length from several days to six weeks. These courses do not as yet lead to recertification, due to outdated State requirements. This is a general series for new operators of water and wastewater treatment plants that starts with the basic skills and becomes increasingly complex. The series generally takes one to one-and-a half years to complete. Most courses are designed for those already working in the field. During Fiscal Year 1976, approximately 600 students participated. The courses offered at the facility for potable water are listed below.

a) Waterworks Microbiology
b) Hydraulics and Pumping
c) Advanced Waterworks Technology
d) Coagulation and Sedimentation
e) Theory and Practice of Waterworks Operators
f) Distribution Systems
g) Well Systems

The facility's staff has recently collected data dealing with the training and experience of operators in the State. Dividing operators into categories according to years of experience, they found the following:

	Experience	% Of Operators
I.	Less than one year	15%
II.	One to two years	10%
III.	Two to five years	35%
IV.	More than five years	40%

Officials believe that operators in category I need four weeks of training the first year, those in categories II and III need approximately two weeks per year, and those in category IV need two years per year to maintain skills and stay abreast of new developments. It is the facility's aim to take each operator through a comprehensive training program with well-defined goals so that the confidence and expertise needed to operate a plant in the most efficient manner possible will be developed. To accomplish this, the following general program is proposed:

1) First year - Basic mathematics, chemistry, and principles of operation; four weeks.
2) Second year - Mechanical operations and maintenance; two weeks.
3) Third, fourth and fifth years - Special operations; one week.
4) Maintenance of skills; sixteen hours per year.

Officials feel that field training is an indispensible part of a vocational program. In order to ensure that the operators are using their newly acquired skills to the fullest, and to help them acquire new skills, it is proposed that each system receive a visit by a field instructor at least once a year.

To provide the classroom and field training that State officials feel is necessary, a total of 18 instructors will be required, according to State calculations. The Operator Training Center is not large enough to accomodate this size staff, and some of the instructors would be located in the Department's regional offices.

E. Career Potential

Opportunities should become increasingly available within the Division of Water Quality Control for scientists and engineers for carrying primary enforcement responsibilities of the Safe Drinking Water Act. Requirements are expected to increase for operators of water treatment plants and distribution systems. Because of the increasing complexity of facilities, there will be an increased need for persons with greater skills and expertise in operations, laboratory control and monitoring. Sources indicate that new entrants into the field need not have previous related education or experience, and that adequate knowledge can be attained through the upgrade process.

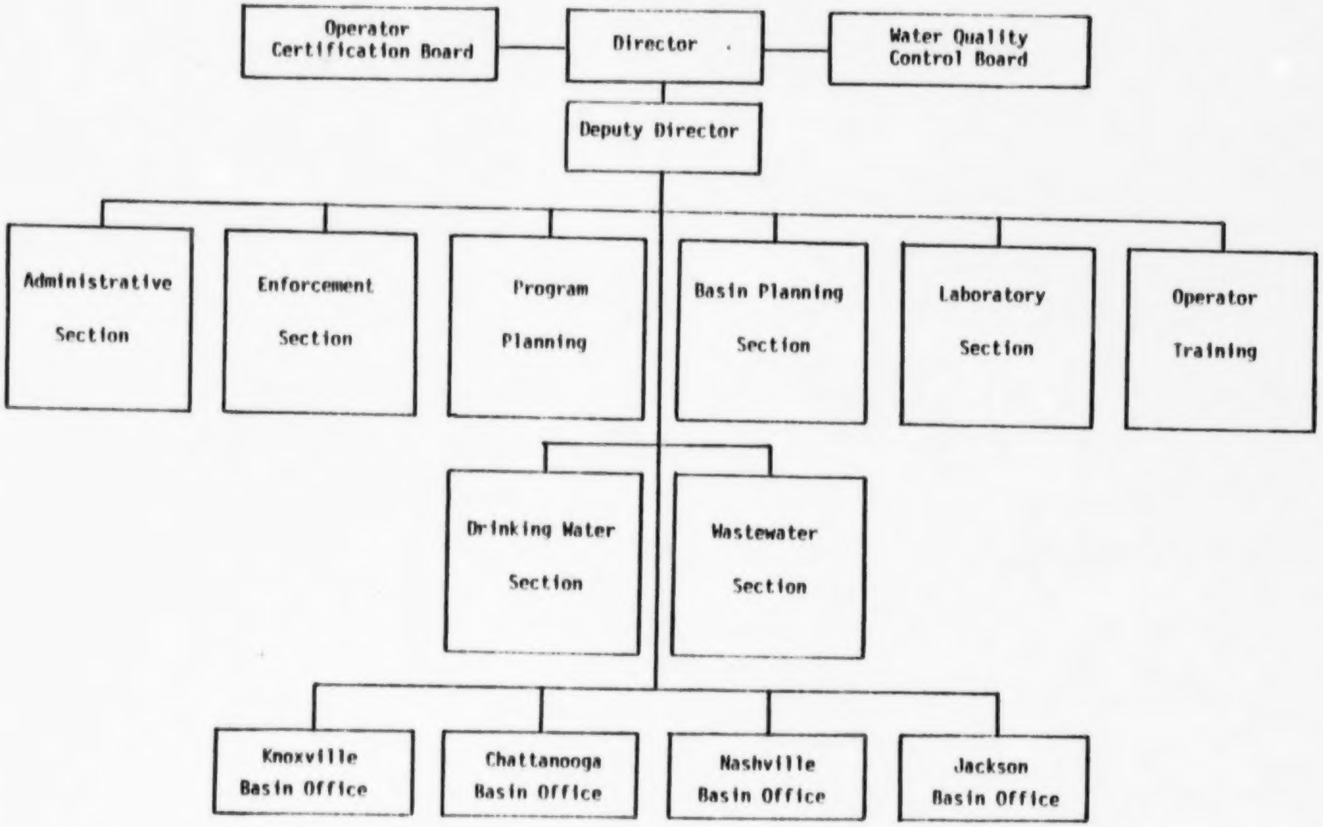
F. Conclusion

Tennessee is currently working toward achieving primary enforcement responsibilities for the Federal Safe Drinking Water Act. In preparation, staffs in the Department of Public Health are being increased, and are expected to continue growth during the next five years. State budget restrictions could prevent the program from being staffed to its required capacity for implementing a viable program.

The number of water treatment plant and distribution system personnel is projected to increase over the next five-year period, and increased demands are expected to occur for operators with high levels of expertise. The State Operator Training Center is currently supplying most of the training available to operators in the State, chiefly through an upgrade training process. In order to meet future needs, the Center proposes to develop a comprehensive vocational program to meet the needs of all levels of plant and system personnel. In order to do so, significant increases in instructional personnel will be required and again, State budget limitations may prevent the development of such a program.

TENNESSEE DEPARTMENT OF PUBLIC HEALTH
Environmental Health Services Bureau
Division of Water Quality Control

Figure 4


Operator Certification Board
Director
Water Quality Control Board
Deputy Director
Administrative Section
Enforcement Section
Program Planning
Basin Planning Section
Laboratory Section
Operator Training
Drinking Water Section
Wastewater Section
Knoxville Basin Office
Chattanooga Basin Office
Nashville Basin Office
Jackson Basin Office

V. RADIATION

A. Introduction

The Tennessee Radiological Health Service Act (Tennessee Code Annotated Section 53-3303) empowered the State's Public Health Commissioner to create a radiological program within the Department of Public Health. The Act authorized the following activities:

1) To collect and disseminate radiological health information;
2) To develop rules and regulations with regard to radiological safety; and,
3) To require the reporting of unexpected or otherwise unplanned incidents of excessive exposure as the rules and regulations may direct, and to take such immediate steps as may be necessary to cope with the resultant hazards.

Tennessee has a number of nuclear power reactors and facilities within its borders. The Tennessee Valley Authority (TVA) is constructing two two-unit reactors (Sequoyah and Watts Barr) that are scheduled for completion in 1978 and 1979-1980. Three additional plants are proposed, but not scheduled for completion until after 1982.

Other Tennessee nuclear operations include the Nuclear Fuel Service at Erwins, the U.S. Nuclear Corporation at Oak Ridge and the Exxon Nuclear Plant at Oak Ridge, which is scheduled to begin fuel storage in 1980. Union Carbide Corporation operates the National Laboratory and other nuclear facilities including the Gaseous Diffusion Plant for the Energy Research and Development Administration at Oak Ridge.

The Tenneessee Attorney General's Office has voiced concerns regarding radiological safety at the Oak Ridge facilities. The Oak Ridge area was the site of much of the research for the Manhatten project during World War II, and as a result of poorly-kept records, the locations of nuclear burials made during the war are unknown. In addition, some leaching of radiation from the facilities into the Clinch River is still occurring and as a result, radioactive concentrations in water effluents at times violate radiological standards of the Nuclear Regulatory Commission and the State of Tennessee.

B. Workforce Profile

The state's radiological program is located within the Division of Occupational and Radiological Health of the Department of Public Health's Bureau of Environmental Health Services. The Divisions purpose is to control radiation hazards wherever they are to be found by controlling the use, handling and disposition of radioactive materials and radiation machines. The Radiological Health Section is responsible for controlling radiation in Tennessee through the processes of registration, licensing, inspection and monitoring of sources of such radiation. The Section is divided into three subsections, as follows:

1) Radiation Materials and Emergency Operations: Inspects and licenses facilities in Tennessee which use and possess radioactive materials, except for critical quantities of special nuclear material and federal facilities, which are licensed by the U.S. Nuclear Regulatory Commission. Prepares and responds to plans for emergency situations which may arise in the event of mishaps during the use or transportation of radioactive materials.

2) Radiation Machines and Devices: Registers and inspects all machines that produce ionizing radiation.

3) Radiological Laboratory and Environmental Monitoring: Conducts analyses of milk, air and water samples collected throughout the state to test radiation levels. Monitors levels of radioactivity on a continuous basis at fixed monitoring sites throughout Tennessee with the aid of field instruments. Special off-site air and water monitoring stations are being established in the vicinity of certain nuclear facilities.

Radiological physicists are located in the Division's four Area offices, in Memphis, Nashville, Chattanooga and Knoxville. The Division of Occupational and Radiological Health has a total staff of 51. Within the Radiological Health Section are eleven persons, as depicted in the following table.

TABLE X

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Bureau of Environmental Health Services
Division of Occupational and Radiological Health
Radiological Health Section
Current (1976) Staffing Level

Position	1976
Radiological Physicist	10
Chemist	1
TOTAL	11

Radiological physicists employed by the State of Tennessee must have bachelor's degrees in physics at the entry level. At higher levels, this position requires a master's degree in nuclear engineering, public health, radiological health, or physics and experience in the field. Three of the Section's ten radiological physicists have master's degrees and two have Ph.D. degrees. Turnover in the Section is estimated at approximately five percent per annum.

The Tennessee Valley Authority's radiological health unit is located in Muscle Shoals, Alabama. However, TVA staffs each of its nuclear power plants with one professional health physicist and approximately nine technicians. These personnel are often assigned to the plants several years before actual operation. The Oak Ridge National Laboratory has five health physicists, employees of Union Carbide Corp., performing radiation monitoring.

C. Workforce Projections

Mr. Bill Graham, the assistant director of the Radiological Health Section, stated that the greater of two proposed expansion budgets for additional personnel for Fiscal Year 1977, was turned down by a budget receiving committee within the Governor's Office. This budget request provided for 8 additional positions considered necessary for the Radiological Health Section's program effort for the next five-year period. The purpose of the rejected request was to expand the environmental monitoring functions, as well as to provide for a radiation emergency response capability. Requested were six radiological physicists, one radiological health technologist and one secretary.

The Radiological Health Section also requested two radiation physicists and two technicians for the X-ray inspection program. Sources indicate that this request has a strong likelihood of being granted.

The Section will continue to request the remainder of the orginally-requested positions for Fiscal Year 1977. Workforce projections for 1982, then, provide for the addition of six radiological physicists, one technologist and one secretary.

The turnover rate is very low in the Radiological Health Section, and six people have left in the past 17 years. New personnel are recruited through the Tennessee Department of Personnel and must meet Civil Service Qualifications.

Based upon the above, the following table depicts workforce projections to 1982 for the Radiological Health Section.

TABLE XI

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Bureau of Environmental Health Services
Division of Occupational and Radiological Health
Radiological Health Section
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Radiological Physicist	10	11	13	15	17	17	n/a	11%
Chemist	1	1	1	1	1	1	n/a	0%
Technician	0	2	2	3	3	3	n/a	30%
Other	0	0	0	1	1	1	n/a	20%
TOTAL	11	13	16	20	22	22	15%	15%

The Tennessee Valley Authority will continue to expand its radiological health staff within the nuclear power plants until these plants are fully operational. According to information supplied by TVA's Division of Environmental Planning, by 1982, there should be approximately two health physicists and 18 technicians performing radiation monitoring and control functions within the two TVA nuclear plants in the state.

The assistant director of the Radiological Health Section is currently the chairperson of the Regional Training Committee, which was formed by Region IV Environmental Protection Agency radiation personnel to assist in meeting state training needs. This person has identified the following training priorities for the state radiological program personnel:

1) Planning and conducting an orientation for emergency operations for local police and fire departments. Tennessee conducted an exercise in Sequoia in March of 1976 which involved most Tennessee state agencies;

2) Developing advanced courses on specialized X-ray techniques;

3) Training state personnel regarding the management of radiation accidents caused during transportation of materials;

4) Training regulatory personnel regarding the management of surveillance programs around nuclear facilities.

Personnel of the Radiological Health Section are sent to courses offered by the Nuclear Regulatory Commission. All radiological physicists have attended such courses.

The Division of Occupational and Radiological Health does not offer any formalized training in the field of radiation. However, eight persons have been involved in a three-day training program regarding the handling and transport of hazardous materials that was sponsored by the Governor's Highway Safety Program.

There is currently no certification program for health physicists in Tennessee, but state officials do not feel that a need for such a program exists. These sources have stated that training currently available to employees is adequate and will continually improve particularly as a result of efforts of the Regional Training Committee.

E. Career Potential

The career potential for radiological physicists and technicians in the Radiological Health Section is fairly good. Although the Section is expected to receive the smaller of two budget requests submitted to the State Legislature, the needs for these types of personnel will continue to be recognized by the Section, and their attainment will be promoted. No new careers seem to be emerging, although increasing emphasis is being placed on technician-level positions, both in the state program and in the Tennessee Valley Authority.

F. Conclusion

The staff of the Tennessee radiological health program is likely to increase at a moderate pace over the next five years, and is likely to be double its present size by 1982. As additional nuclear power facilities will become operational by the early 1980's, public concern regarding the safeguarding of facilities is likely to instigate the Legislatures to provide additional funding for the program.

The radiation control staffs are also likely to increase in the nuclear plants of the Tennessee Valley Authority that are currently under construction. Career potentials in the state appear best for health physicists and technicians that are trained in radiation control and monitoring.

VI. SOLID WASTE

A. Introduction

The 1970 Tennessee Solid Waste Disposal Act empowered the Tennessee Department of Public Health "to exercise general supervision over the construction of solid waste processing facilities and disposal facilities or sites throughout the state". The state's solid waste disposal program is related to:

1) Provide for safe and sanitary processing and disposal of solid wastes;
2) Develop long-range plans for adequate solid waste disposal systems to meet future demands;
3) Provide a coordinated statewide program of control of solid waste processing and disposal in cooperation with state, federal, and local agencies responsible for the prevention, control or abatement of air, water and land pollution;
4) Encourage efficient and economical solid waste disposal systems.

The Commissioner of Public Health was provided with the authority to adopt rules and regulations concerning new or existing solid waste disposal facilities. A nine-member Solid Waste Disposal Board was created to advise the Commissioner on new regulations and to act as a Board of Appeals.

Tennessee has 128 registered landfill sites and 13 industrial landfill sites. The state also has one hazardous waste processing facility. Cities and counties in Tennessee which meet the regulations for solid waste management receive, under the state grants rules, $1.00 per capita. In 1976 approximately $2,390.00 or 59¢ per capita was allocated in the Tennessee Solid Wastes Disposal Grants Program. In 1975, the amount allocated averaged to about 57¢ per capita.

The Tennessee Legislature (1977) has passed a proposal to enact hazardous waste legislation. State officials assert that the legislation is very similar to what is required under the Federal Resource Conservation and Recovery Act. The Tennessee law is designed so as to be in conformance with the Federal Legislation.

Resource recovery operations are scrutinized very closely by Tennessee's solid waste management officials. The Division of Solid Waste Management currently administers a state loan program to finance these feasible resource recovery systems.

B. Workforce Profile

The Division of Solid Waste Management, a part of the Tennessee Department of Public Health is the state's principal solid waste management regulatory agency. It is administratively located under the Departments's Bureau of Environmental Health Services.

The Division is responsible for assuring Tennesseans that solid waste materials generated within the state by municipalities or industries are processed in an environmentally acceptable manner. This responsibility includes:

1) The approval of sites for sanitary landfills;
2) The approval of plans for operations of landfills;
3) The approval and administration of solid waste management grant funds; and
4) The approval and administration of Tennessee's Resource Recovery Loan Act.

The Division has field offices in Johnson City, Knoxville, Nashville and Jackson. The Division's central headquarters is located in Nashville.

It also is comprised of four sections:

1) Engineering
2) Environmental Geology
3) Grants and Enforcement
4) Training and Public Education

A total staff of twenty persons comprises the Division of Solid Waste Management. Four engineers are employed by the Division. Two are environmental engineers and two are civil engineers. The Division also has two geologists with master's degrees and an attorney with a bachelor's degree in Mechanical Engineering.

Nine environmental consultants are employed by the Division; two have master's degrees in public health, one in environmental hygiene and four in environmental science. The two other environmental consultants have bachelor's degrees in agriculture.

One operator-trainer is employed by the Division to show bulldozer operators how to properly develop landfill sites. Three secretaries provide administrative support to the Division of Solid Waste Management. The following table depicts the Division's current distribution of personnel.

TABLE XII

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Bureau of Environmental Health Services
Division of Solid Waste Management
Current (1976) Staffing Level

Position	1976
Engineer	4
Attorney	1
Scientist (Environmental Consultant)	9
Geologist	2
Technician	1
Clerical	3
TOTAL	20

The Division recruits personnel through the State Merit System. Geologists employed by the Division are the most difficult to recruit, and this position has the most turnover. Preference in recruiting geologists is given to those with both an engineering and a geology background. Environmental consultants recruited are required to have broad environmental backgrounds.

In the private sector, a hazardous waste processing center in Memphis operated by Environmental Systems, Inc. has three full-time employees, but only two persons work full-time processing hazardous waste materials.

The Division of Solid Waste Management regulates solid waste disposal in virtually every city and county in Tennessee. An estimate of the total number of persons involved in solid waste management activities is based upon the assumption that each landfill site has at least one owner/operator. There are 128 registered landfill sites and 13 industrial landfill sites. Possibly one-half have heavy equipment operators and one-fifth have weighmasters. Based upon those projections, it is estimated that there are at least 214 persons in the State of Tennessee with solid waste management jobs at sanitary landfills. Including the Division's personnel and hazardous waste processing facilities, there may be a total of approximately 230 persons involved in solid waste management activities in both the public and private sectors, excluding collection personnel.

C. Workforce Projections

Workforce projections for the Division of Solid Waste Management are based upon professional judgements of its administrators. For Fiscal Year 1977, the Division has submitted a request to the Tennessee Legislature for appropriations amounting to $150,000 to operate a first year hazardous waste management program. If the Tennessee hazardous waste legislation is enacted, the state's hazardous waste management program will be partially financed through a fee system under which process and waste disposal operators will be charged. However, state officials were not confident that the Tennessee Legislature will approve their request for funding for first year program operations.

If the state hazardous waste law is enacted and approved, additional federal funds will be needed to fulfill workforce needs. The Division will require three engineers, one administrator, a chemist and three secretaries to operate its hazardous waste management program for its first year of operation.

The non-hazardous waste management portion of the Division's program is currently understaffed and more field personnel are needed. For 1977, the Division has requested additional personnel including one engineer, one environmental consultant and one administrator for the solid waste management program.

For 1978, the hazardous waste management program needs two more engineers, and one chemist and one geologist is needed for the solid waste management program. For 1979, the hazardous waste management program needs one attorney, one engineer and a chemist for its third year operation. Also by that time, one additional engineer will be needed for solid waste management activities.

After 1980, the Division's administrators could not foresee what the needs for additional hazardous or solid waste management personnel will be. The projections are depicted in the following table and include both the hazardous waste and solid waste management programs.

TABLE XIII

TENNESSEE DIVISION OF SOLID WASTE MANAGEMENT

Hazardous and Solid Waste Management
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	4	8	10	10	12	12	n/a	29%
Geologist	2	2	3	3	3	3	n/a	10%
Scientist	9	11	12	12	13	13	n/a	6%
Technician	1	1	1	1	1	1	n/a	0%
Other	4	9	9	9	10	10	n/a	27%
TOTAL	20	31	35	35	39	39	5%	12%

Administrators of the Division of Solid Waste Management estimate that the Division loses one person each year, for an average annual turnover rate of five percent.

D. Training and Certification

The Division's administrators have a policy for all of its professional personnel to eventually obtain master's degrees in solid waste management. At the present time, one of the Division's geologists is upgrading his abilities by taking engineering and environmental courses, although he already has a master's degree in geology. In sending its professionals back to school to obtain a master's degree, the state pays tuition and three-fourths of each person's salary.

The University of Tennessee Center for Government Training and the Division of Solid Waste Management sponsored a series of five seminars in May, 1976 throughout Tennessee to discuss all aspects of hazardous waste management. The purpose of these discussions was to inform industry's representatives of possible problems and solutions regarding hazardous waste management. A preliminary draft of Tennessee's hazardous waste management legislation was discussed with the participants of these seminars.

The Division of Solid Waste Management conducted an operator training school of sanitary landfill operators and supervisors in Murfreesboro, Tennessee at the Wastewater Training Center. Solid Waste Management also was one of the principal topics discussed at the Tennessee Chapter of the American Public Works Association's annual meeting in Memphis on October 27-29, 1976.

Certification is not presently required for landfill operators in the State of Tennessee. The Division of Solid Waste Management does conduct a training program for landfill operators twice a year. These courses usually last two days, and operators receive certificates signifying that they have completed the course. The Division evaluates landfills on-site, and every landfill must have at least one registered operator to be in total compliance with the law.

E. Career Potential

The career potential for professionals at the Division of Solid Waste Management, local governments and private industry in Tennessee seems rather bright for the next five-year period. The potential for professionals such as engineers and chemists to work on hazardous waste projects in the Division looks especially good, as the Division plans to double its staff during the next five years.

F. Conclusion

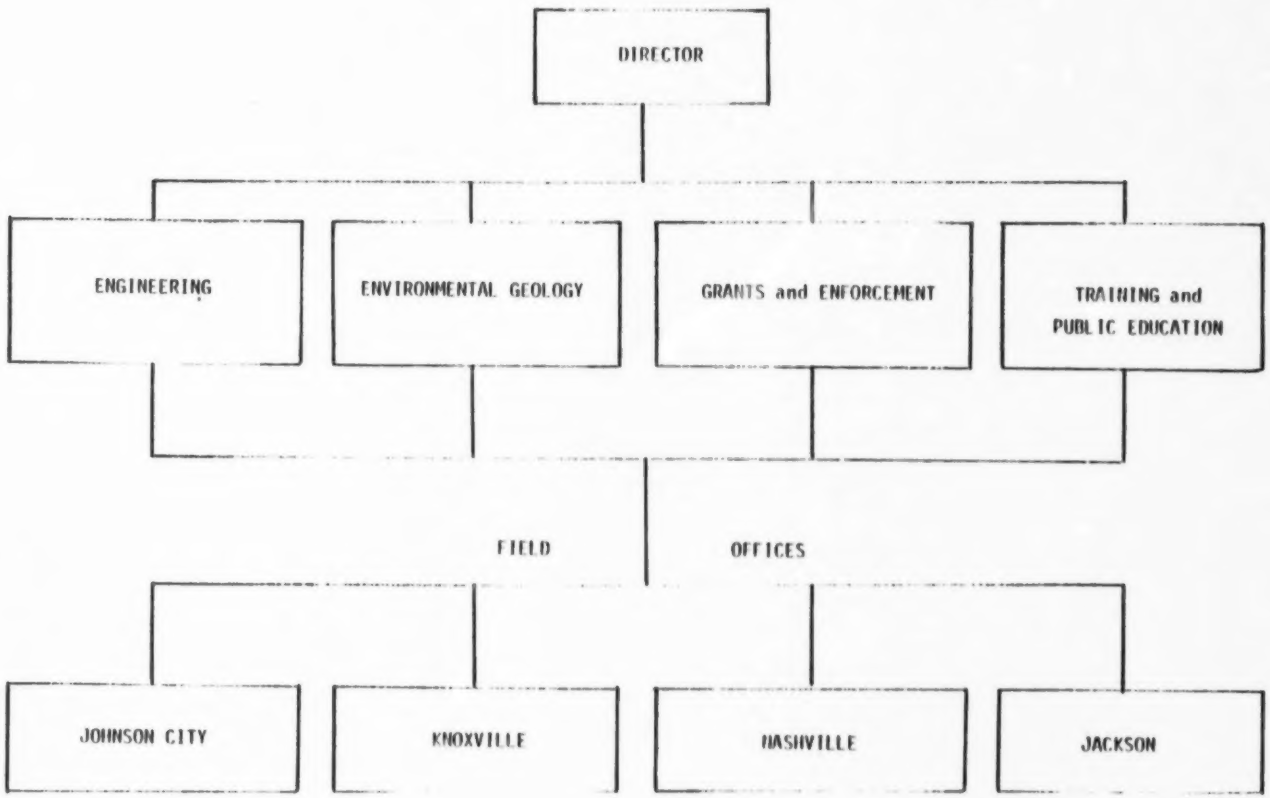
The State of Tennessee is very close to passing a Hazardous Waste Management law within the first six months of 1977. If such legislation passes, the Division of Solid Waste Management is prepared to develop regulations in order to receive primacy for the program.

The Division of Solid Waste Management does not plan to promote resource recovery systems during the next five year period because of costs and potential market problems. Sanitary landfills are still considered to be the most economical method of disposing of solid wastes. Most Tennessee cities will probably continue landfill operations until resource recovery technology can be further developed and refined.

Fairly significant workforce growth will mark Tennessee solid waste programs over the next five years. In addition, a well-developed upgrade program and public education information can be expected to continue.

TENNESSEE DEPARTMENT OF PUBLIC HEALTH
Bureau of Environmental Health Services
Division of Solid Waste Management

Figure 5


DIRECTOR
ENGINEERING
ENVIRONMENTAL GEOLOGY
GRANTS and ENFORCEMENT
TRAINING and PUBLIC EDUCATION
FIELD
OFFICES
JOHNSON CITY
KNOXVILLE
NASHVILLE
JACKSON

VII. WASTEWATER

A. Introduction

The Tennessee Water Quality Control Act of 1971 created a Water Quality Control Board for exercising supervision over the administration and enforcement of the Act and its Rules and Regulations. The Board consists of seven members: three ex-officio members and four citizen members. The Board must hold public hearings for the purpose of classifying or reclassifying the State waters, adopt, modify and repeal rules and regulations, formulate and adopt a State Water Quality Plan and hear appeals from orders or permits. Administration and enforcement of the Act is charged to the Tennessee Department of Public Health.

The Act requires that permits be obtained from the Department for the construction, installation or modification of treatment works, for the construction or installation of any establishment that would cause an increase in the discharge of wastes into the State's waters, and for the construction of any new outlet for the discharge of any wastes into the waters of the State. Permits are also required for operating treatment plants, and for discharging wastes. Whenever a new work or change in existing work for waste discharge is planned a registered engineer must plan, design, and inspect the facility's construction and must assist in the start-up of and outline correct operating procedures for the facility. Tennessee has not yet been delegated NPDES permitting authority.

The Public Water and Wastewater Environmental Health Act of 1971 classifies wastewater treatment plants and collection systems according to the size of populations served and treatment characteristics. Persons in direct responsible charge of wastewater treatment plants and collection systems must become certified under the provisions of the Act. A Certification Board is created by the Act to advise and assist the Department of Public Health in the administration of the certification program. The Board is charged with the responsibility of conducting all work necessary to promote the program and maintain records, and to adopt rules and regulations required in performing its obligations. The Board is composed of the following members:

1) Two members who are currently employed as water or wastewater operators holding valid certificates;
2) One member to represent the municipalities of Tennessee,
3) One member who is a faculty member of a college, university, or state technical institute, whose major field is related to sanitary engineering; and
4) One ex-officio member representing the Tennessee Department of Public Health.

There are 320 major wastewater treatment plants in the State, not including the very small package plants. These plants process 500,000 to 50 million gallons per day, and operations vary from manual to highly sophisticated. The Department of Public Health provides training to personnel in these facilities through the Tennessee State Operator Training School in Murfreesboro, Tennessee.

B. Workforce Profile

Functions relating to wastewater pollution control are carried out in the Division of Water Quality Control of the Department of Health's Environmental Health Services Bureau. The Division is made up of eight main sections and four basin offices. The components and approximate percentages of time devoted to wastewater, as opposed to potable water are depicted below.

Component	% For Wastewater
Administrative Section	95%
Enforcement Section	90%
Program Planning	90%
Basin Planning Section	90%
Laboratory Section	90%
Operator Training	50%
Drinking Water Section	0%
Wastewater Section	100%
Basin Offices (in Knoxville, Chattanooga, Nashville, Jackson)	85%

Among the duties and responsibilities carried out in the Division for wastewater control are the following:

1) The issuance of permits for municipal and industrial facilities;
2) Carrying out all appropriate planning activities as required by P.L. 92-500, including Section 208 areawide wastewater management planning for non-designated areas;
3) Coordinating municipal construction grants and loans;
4) Conducting effluent monitoring;
5) Performing stream calculations and determining effluent limits;
6) Carrying out biological and chemical analyses and certifying laboratories;
7) Training wastewater treatment plant operators.

As of October, 1976, there were 174 persons working within the Division of Water Quality Control. Eleven of these were in the Wastewater Section, as follows: seven engineers, one geologist, one biologist, one wastewater technician and one secretary. In the remaining divisions, approximately 148 person-years were dedicated to wastewater, broken down approximately as follows: 47 engineers; 17 biologists; 21 chemists; 4 attorneys; 23 water quality specialists; 3 planners; 4 instructors; 9 co-op students; and 20 others for a total of 148.

Engineers chiefly come from sanitary and civil engineering backgrounds. Water Quality Specialists are degreed persons, mainly in the areas of biology and chemistry, yet this position pays less than the position classifications of biologist and chemist. For filling instructor positions, administrators search for persons with degrees in a related field and experience in operating water and/or wastewater treatment plants. All positions are filled through the State Civil Service Board. Qualified engineers are often not listed on the Board's register, in which cases the Division initiates recruitments through universities.

The following table depicts approximations of workforce levels devoted to wastewater control in the Division of Water Quality Control, based upon input from administrators. Figures are depicted in person-years.

TABLE XIV

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Wastewater Pollution Control
Current (1976) Staffing Level (est.)

Position	1976
Engineer	54
Attorney	4
Scientist	63
Trainer	4
Technician	1
Other*	33
TOTAL	159

*Includes administrators, planners, co-op students, clerical and other support positions.

The Division directs special attention toward the control of water pollution from surface mining activities. Within the Wastewater Section, a geologist and a biologist are involved in this activity, as are five persons scattered throught the basin offices.

Wastewater treatment plants are classified into four categories, according to population served, type of works, character and volume of wastes to be treated, and the use and nature of the water resources receiving the plant effluent. Operators in direct charge of wastewater treatment plants must be certified at the level of the plant operated, or at a higher level. All other operators are encouraged to become certified. In a small system, or in a wastewater collection system, a single person may become the certified opertor for more than one function. To become certified, persons must fulfill all specified requirements including the passage of a written examination. A certificate indicates that portion of the plant or system for which a person is qualified to operate. Grade I operators must have at least one year of experience in a Group I plant and pass the required written examination. Increasing amounts of education and operating experience are required to be qualified for certification at higher levels. The requirements for collection systems are the same as for treatment plants except that experience must be in the collection system.

Records of the Department of Public Health indicate that there are currently 1064 certificates issued for wastewater operations. The actual number of operators, however, is approximately 700, as many operators hold certificates in two or more categories. The department has provided the following breakdown of certificates:

TABLE XV

STATE OF TENNESSEE

Wastewater Treatment Plant and Collection System Operators Current (1976) Certificates

Category	1976
Wastewater Treatment Plants (Classifications I-IV)	607
Package Plants	96
Lagoons	74
Collection Systems (Classification I - III)	287
TOTAL	1064

Only the very large treatment plants employ full-time laboratory workers and full-time maintenance workers. State sources estimate that approximately 50 of each type of personnel are employed in treatment plants in the State. In the remaining plants, operators perform these required functions. Field research indicates that there are approximately 600 uncertified operators in the State, for a total of approximately 1400 persons in the State working in wastewater treatment plants.

State sources indicate that larger industries are forming environmental staffs to deal with wastewater problems, where in past the plant managers assumed these duties. An estimated 50 persons in the State, principally engineers, are employed by industries for wastewater control. Those plants that do not have full staff capabilities retain the services of private consulting firms. State sources again estimate that twenty to thirty firms that have these capabilities are located in the state.

The Division of Environmental Planning of the Tennessee Valley Authority employs 170 persons in its Water Quality and Ecology Branch in Chattanooga that perform activities in the field of wastewater and water quality control. Approximately 200 persons in TVA's office of Engineering Design and Construction in Knoxville currently participate in air and water pollution control activities for TVA's power plants. In addition the Division of Water Management, also in Knoxville, employs approximately 140 persons that spend two-thirds of their time in air and water monitoring programs.

Taking into account the State program, facility operations, TVA, industries and private consulting firms, it appears that there are over 2,100 persons in the State of Tennessee engaged in water pollution control activities on a full- or part-time basis.

C. Workforce Projections

The Division of Water Quality Control has prepared an amendment to the Water Quality Control Act to allow the State to assume NPDES permitting authority under P.L. 92-500, the Federal Water Pollution Control Act. A copy of the amended bill is currently in the hands of legislative committees, and public hearings will be held in the near future. The House has passed the bill, but the bill has not yet passed the Senate. Some opposition to the proposed amendment has been expressed, but State officials believe that passage will occur in 1977 or 1978.

If the State assumes NPDES permitting authority, an estimated eight additional persons will be required for the Division of Water Quality. New persons would probably include one attorney, and additional engineers and specialists. Officials believe that with present State legislative budget constraints, federal funds will be required to add these positions.

Additional increases in the next five years are not anticipated, chiefly due to the State budget constraints. New areas of involvement such as toxic substances and non-point source control are now and will most likely continue to be addressed by existing personnel. Needs for additional instructors in the State Operator Training School have been voiced, to meet the projected requirements for operator training. A report prepared by the staff of the Operator

Training School states that to provide the training needed for well-staffed systems in the State, a total of 18 instructors are needed, along with the program director, three secretaries and a custodian. Increased needs are caused both by a projected increase in the number of operators and by a needed expansion of the training program, to be described in more detail later in the report. Again, budget restrictions may prevent the addition of the instructors.

The following table depicts workforce projections to 1982 for the State's wastewater program. This table has been developed under the assumption that NPDES permitting authority will be attained in 1978, and that budget constraints will not ease. It should be noted that expressed needs are actually higher than the projections.

TABLE XVI

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

Wastewater Pollution Control
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%annum turnover (average)	%annum growth (average)
Engineer	54	54	58	58	58	58	10%	1%
Attorney	4	4	5	5	5	5	5%	5%
Scientist	63	63	66	66	66	66	5%	1%
Trainer	4	4	4	4	4	4	5%	0%
Technician	1	1	1	1	1	1	5%	0%
Other	33	33	33	33	33	33	5%	0%
TOTAL	159	159	167	167	167	167		1%

The turnover rate is highest for engineers because of the demand for these professionals throughout the public and private sectors. The supply of chemists and biologists is presently greater than the demand, and these positions are most easily filled.

Using staffing guidelines recommended by the U.S. Environmental Protection Agency for wastewater treatment plants, State officials have determined that to properly staff the systems in the State, 1,285 wastewater treatment plant operators are needed, and 642 persons are needed to staff the collection systems. These sources believe that the plants will be staffed to this estimated required level within five years.

The following lists the staffing requirements, as developed by the Tennessee Department of Public Health for wastewater facilities throughout the State.

Type of Facility/System	No.	Workforce Required
Lagoons	87	87
Primary	4	7
Facilities≤.5 MGD (excluding lagoons)	148	222
Trickling Filter	54	295
Activated Sludge	45	674
Collection Systems	N/A	642
TOTAL		1,927

Also, because the number of systems is expected to increase and treatments are becoming more complex, the numbers of laboratory workers and maintenance workers is expected to increase at a rate similar to the projected growth rate of operators. Based upon the available information, the following table depicts the workforce projections for operators (certified and uncertified) of wastewater treatment plants and collection systems, and for laboratory and maintenance personnel.

TABLE XVII

STATE OF TENNESSEE

Private Sector Wastewater Plant Operators
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%annum growth (average)
Operator	1300	1425	1551	1676	1802	1927	8%
Chemist/Lab Technician	50	55	60	65	70	75	8%
Maintenance	50	55	60	65	70	75	8%
TOTAL	1400	1535	1671	1806	1942	2077	8%

Most uncertified people in plants are semi-skilled, and exhibit a high turnover rate. The average length of stay in the field for these persons is two to three years. If these persons become certified within this time frame, they are apt to stay in the field indefinitely. Since the implementation of the mandatory certification law in 1971, the average operator turnover rate has dropped, and the average operator age has dropped by fifteen or twenty years.

State sources believe that industries will continue to increase wastewater staffs during the next five years as enforcement increases and requirements become more stringent. These sources indicate that the number may double within this period. The number of consulting firms servicing the field, however, is not expected to grow appreciably.

The staff of the Water Quality and Ecology Branch of TVA's Division of Environmental Planning is projected to increase from 170 to 219 by 1982. Increased needs are projected to occur in the Office of Engineering Design and Construction, although specific numbers have not been determined. The Division of Water Management projects few additional workforce requirements.

Again compiled information concerning the State program, TVA, wastewater facilities, private industries and consulting firms indicates that the number of persons in the State working in the wastewater field on a full- or part-time basis may approach 3,000 within the next five years.

D. Training and Certification

Nearly every new entrant to the Division of Water Quality Control receives informal OJT under the supervision of a senior staff member for six to twelve months. Upgrade training is also offered to all professionals in the division. Short courses are available through EPA at Athens, Georgia (Region IV EPA) or Cincinnati, Ohio, and through universities and the Division's Operator Training Center in Murfreesboro. Employees are also encouraged to attend night school courses in related fields, for which the Division will pay tuition fees. Two to three persons per year are able to attend school for attaining master's degrees, also funded by the Division. Finally, basic management courses are offered at the University of Tennessee, in which many Division employees participate.

In the State Operator Training School, special on-the-job training must be offered to new instructors as persons with the desired qualifications are difficult to find. New entrants spend two weeks working in a water treatment plant and the same amount of time in a wastewater treatment plant. Instructors also participate in technical upgrade training courses.

Although the Operator Training Section of the Division has been in existence since 1971, the Tennessee State Operator Training School was built in 1973. The facility was built largely due to the impetus and support of the Tennessee Water and Wastewater Association. State funds supported construction of the facility, and equipment was added with federal funds, under 92-500. Four of the six instructors are supported through two federal grants. Three types of training are offered by the facility's staff:

1) Package Plant Schools: This is an upgrade program, consisting of five courses offered at various locations throughout the State for operators of small wastewater systems. During Fiscal Year 1976 approximately 300 operators participated.

2) Two and Three-Day Courses: Three times per year these courses are offered for water and wastewater treatment plant personnel in local community colleges and universities. These are designed to meet recertification requirements. Approximately 300 operators participated during Fiscal Year 1976 (water and wastewater).

3) Upgrade and Improvement Courses: Eighteen courses are offered at the training facility that vary in length from several days to six weeks. These courses do not as yet lead to recertification, due to outdated state requirements. This is a general series for new operators of water and wastewater treatment plants that starts with the basic skills and becomes increasingly complex. The series generally takes one to one and one half years to complete. Most courses are designed for those already working in the field. During FY 1976, approximately 600 students participated. Courses offered at the facility for wastewater are as follows:

Coagulation and Sedimentation
Colorimetric Methods for Metals
Chemical Oxygen Demand Laboratory
Lagoon Systems
Advanced Wastewater Technology
Discharge Effects on Receiving Streams
Collection Systems Workshop
Theory & Practice of Wastewater Operations
Wastewater Microbiology
Oils and Floating Materials

The facility's staff has recently collected data dealing with the training and experience of operators in the State. Dividing operators into categories according to years of experience, they found the following:

	Experience	% Of Operators
I.	Less than one year	15%
II.	One to two years	10%
III.	Two to five years	35%
IV.	More than five years	40%

It is the facility's aim to take each operator through a comprehensive training with well-defined goals in order to develop the confidence and expertise needed to operate a plant. To accomplish this, the following general program is proposed:

1) First year-basic mathematics, chemistry, and principals of operation; four weeks.
2) Second year-Mechanical operations and maintenance; two weeks.
3) Third, fourth and fifth years-special operations, e.g. activated sludge, trickling filters, sludge digestion; one week per year.
4) Maintenance of skills; sixteen hours per year.

Officials feel that field training is an indispensible part of a vocational program of this sort. In order to ensure that the operators are using their newly acquired skills to the fullest, and to help them acquire new skills, it is proposed that each system receive a visit from a field instructor at least once a year.

To provide the classroom and field training that State officials feel is necessary, a total of 18 instructors will be required, according to State calculations. The Operator Training Center is not large enough to accomodate this size staff, and some of the instructors would be located in the Department's regional offices.

E. Career Potential

If NPDES permitting authority is achieved, opportunities will exist in Division of Water Quality Control for scientists and engineers. Additional workforce needs have been expressed within the Division, particularly for instructors of treatment plant operators. However, if the State legislature continues implementing stringent controls, State workforce additions for wastewater will be few.

Needs for additional numbers of operators of wastewater treatment plants and collection systems have been documented, and persons with higher degrees of expertise in the field will be required because of the increasing complexity of plants.

Career opportunities are expected to increase within the Tennessee Valley Authority for engineers, scientists and technicians in the field of wastewater and water quality control during the next five-year period.

F. Conclusion

Tennessee has not yet accepted NPDES permitting authority, and if state legislation is amended and federal funds are received for the required personnel, the program should become functional within the next several years. Other workforce needs have been identified, but strict budget controls may preclude additional staff increases.

A mandatory certification law is in effect for lead operators of wastewater treatment plants and collection systems. The number of operators is expected to increase plant staff to the required levels, as the number of plants increase, and as operations become more complex. The Department of Public Health operates an operator training program through its operator training school. To meet projected requirements for keeping the state's facilities adequately staffed with capable personnel, a program expansion is envisioned that would offer a complete vocational curriculum and field training. An increased number of instructors will be required in order to expand the program to its regional level. If these additions do not take place, sources anticipate that Tennessee's systems will not become adequately staffed with persons of the required caliber to comply with state and federal laws.

VIII. ENERGY

A. Introduction

The Tennessee Energy Office is the designated state energy lead agency. The Office was created by an Executive Order of the Governor of Tennessee in May, 1974. The Office was established to advise the Governor and the Tennessee Legislature on the general energy situation and to develop measures to minimize the State's energy problems. The Tennessee Energy Office has the following responsibilities:

1) to plan, develop, coordinate, and implement a State energy program and policy;
2) to coördinate all inter-governmental energy programs;
3) to coordinate energy conservation, contingency planning, energy allocation, data collection, analysis, research, and development, public information and education;
4) to provide forecasts of energy conditions, assess shortages, and recommend energy legislation for State policy;
5) to administer the Emergency Petroleum Allocation Act of 1973;
6) to maintain liaison activities with energy suppliers, distributors and agencies of other States and the Federal government on energy matters; and
7) to be a clearinghouse for information on all energy-related programs and research and development projects in the State.

The Office has two major programs: Data Collection and Conservation. The principal function of the Data Collection Program is to conduct research in pertinent disciplines. The Program has recently completed surveys on use of fuels by public schools, natural gas users and distributors in Tennessee, and coal usage in the State. The activities under the

Conservation Program are related directly to the mandates of the Energy Policy and Conservation Act. Under this program, the Office is conducting training seminars to instruct students to assist homeowners in reducing energy costs. It is estimated that approximately 1,000 students with participate in the program. The goal of the program is to provide assistance to 150,000 Tennessee homeowners in evaluating the energy efficiency of their homes.

A Governor's Advisory Committee was recently created. The Committee has primary responsibility in assisting with the development of a State Energy Conservation Plan. The Committee has worked in conjunction with the Tennessee Energy Office and the University of Tennessee Environmental Center to prepare the proposal for submission to the Federal Energy Administration.

The Tennessee Valley Authority, a major energy producer for the Southeast United States, will be discussed at length in a special report on the Authority.

B. Workforce Profile

The Tennessee Energy Office employs 16 persons; the staff consists of administrators, energy management advisors, energy analysts, and energy analyst trainees. The following table depicts the current staffing level of the Office.

TABLE XVIII

TENNESSEE ENERGY OFFICE

Current (1976) Staffing Level

Position	1976
Administrator	4
Attorney	1
Energy Analyst	4
Clerical	3
Other	4
TOTAL	16

The other category includes one Data Collection and Analysis Officer, one Technology Advisory, one Allocation and Conservation Officer, and one Budget and Personnel Officer. Emphasis in hiring of new employees for the Office is placed on recruitment of persons with energy management expertise in public administration.

C. Workforce Projections

The Tennessee Energy Office was unable to make specific personnel projections for the next five years. The Office indicated that there would be a growing need for more conservationists and lawyers. The conservationists would be needed to work in the area of grant review and development. Lawyers with specific experience in Energy regulatory and administrative procedures will be recruited. No specific projections can be made on future personnel requirements, since new positions will be totally dependent upon the availability of funds.

D. Training and Certification

There are no certification programs either currently operational or planned for personnel in energy-related environmental fields. Those persons who will be employed by existing energy program will be recruited through a variety of sources: colleges and universities with related programs, other state program, and through professional journals. Other than general biology, chemistry and engineering programs, colleges and universities have limited programs in energy/environmental fields.

E. Career Potential

With the limited availability of information concerning energy programs, it is impractical to offer trends for career potentials in the energy conservation and conversion field. However, giving consideration to the growing energy shortage, it is reasonable to assume that while job opportunities may be declining in the traditional energy programs, there may be a considerable increase in the demand for all personnel with experience in nuclear energy. The extent of this demand will be equivalent to the availability of radioactive materials to power the plants.

F. Conclusion

The Tennessee Energy Office is in the process of developing a comprehensive energy program. To date, lack of funds has prohibited the total development of program options. However, the Office is optimistic about the possibility of raising funds required to implement the programs as fully as it believes necessary.

Employment opportunities in the energy/environmental field in the state appear to have stabilized. However, if the five nuclear generating facilities which are proposed for construction during the next five years are successfully completed, there will be a major demand for energy related occupations within the state. This growth will certainly have a significant impact upon all levels of employment opportunties within energy/environmental disciplines. No exact projections can be made on the total impact of the operation of the five proposed facilities. In conclution, it is anticipated that all energy related occupations in Tennessee will experience considerable growth during the next five to ten years.

TENNESSEE VALLEY AUTHORITY

ACKNOWLEDGEMENT

Special thanks are due to Ms. Dawn Ford of the TVA Information Office for her assistance in coordinating data-gathering efforts throughout TVA. Valuable support and assistance for this report were also provided by the Division of Environmental Planning. Particularly helpful were Mr. C.E. Odell, Mr. David Collins and Ms. Mary Harper. Also of importance was the assistance of Mr. Bill Norwood and Mr. Morris Herndon of the Office of Engineering Design and Construction and Mr. Harry Sherwood and Mr. Edward Lesesne of the Division of Water Management. Appreciation is also extended to Mr. Dave Patterson of TVA's office of Planning and Budget and Mr. John Lopez, Mr. Bruce Cadotte and Mr. John DeBoard of the Office of Power for their contributions to this report.

PREFACE

This report presents existing workforce levels, training programs and career potentials and develops staffing level projections (1976-1981) based upon available information for the Tennessee Valley Authority for the pollution control fields dealt with in that agency. This study was carried out for the United States Environmental Protection Agency by National Field Research Center, Inc.,of Iowa City, Iowa.

The information and data presented in this report were compiled in large part from extensive interviews with professionals in TVA, and were supplemented by telephone surveys and research.

FOREWORD

The material herein contains the data collected chiefly from three offices/divisions within the Tennessee Valley Authority. Data are focused upon environmental activities carried out in these components and present workforce profiles, projections, growth and career potentials within these components. Growth projections are necessarily based on best professional estimates developed from available information and represent what are felt to be realistic figures by experts in the respective areas. The three TVA components focused upon in this report are as follows:

The Division of Environmental Planning
The Office of Engineering Design and Construction
The Division of Water Management

Research and development efforts in TVA with regard to the environment and energy conversion/conservation are also discussed. Functions of all TVA components may be found in the Appendix.

TENNESSEE VALLEY AUTHORITY

POLLUTION CONTROL AND ABATEMENT PROGRAMS

TENNESSEE VALLEY AUTHORITY

Environmental Pollution Control and Abatement

A. Introduction

The Tennessee Valley Authority (TVA) is a corporate agency of the United States Government that was established by an Act of Congress in 1933 to develop the Tennessee River system and to assist in the development of other resources of the Tennessee Valley and adjoining areas. The production and sale of electric power are a part of TVA's resource development program. TVA supplies power at wholesale to 160 municipal and cooperative distributors and one privately owned electric system which in turn distribute power to about 2.5 million customers in parts of seven states, including Tennessee, Mississippi, Alabama, Georgia, North Carolina, Virginia, and Kentucky. While the production of power remains a chief activity of TVA, the Authority also participates in such major activities as river development, soil and water conservation, local flood damage prevention, malaria control, forest management, and assistance to local governments.

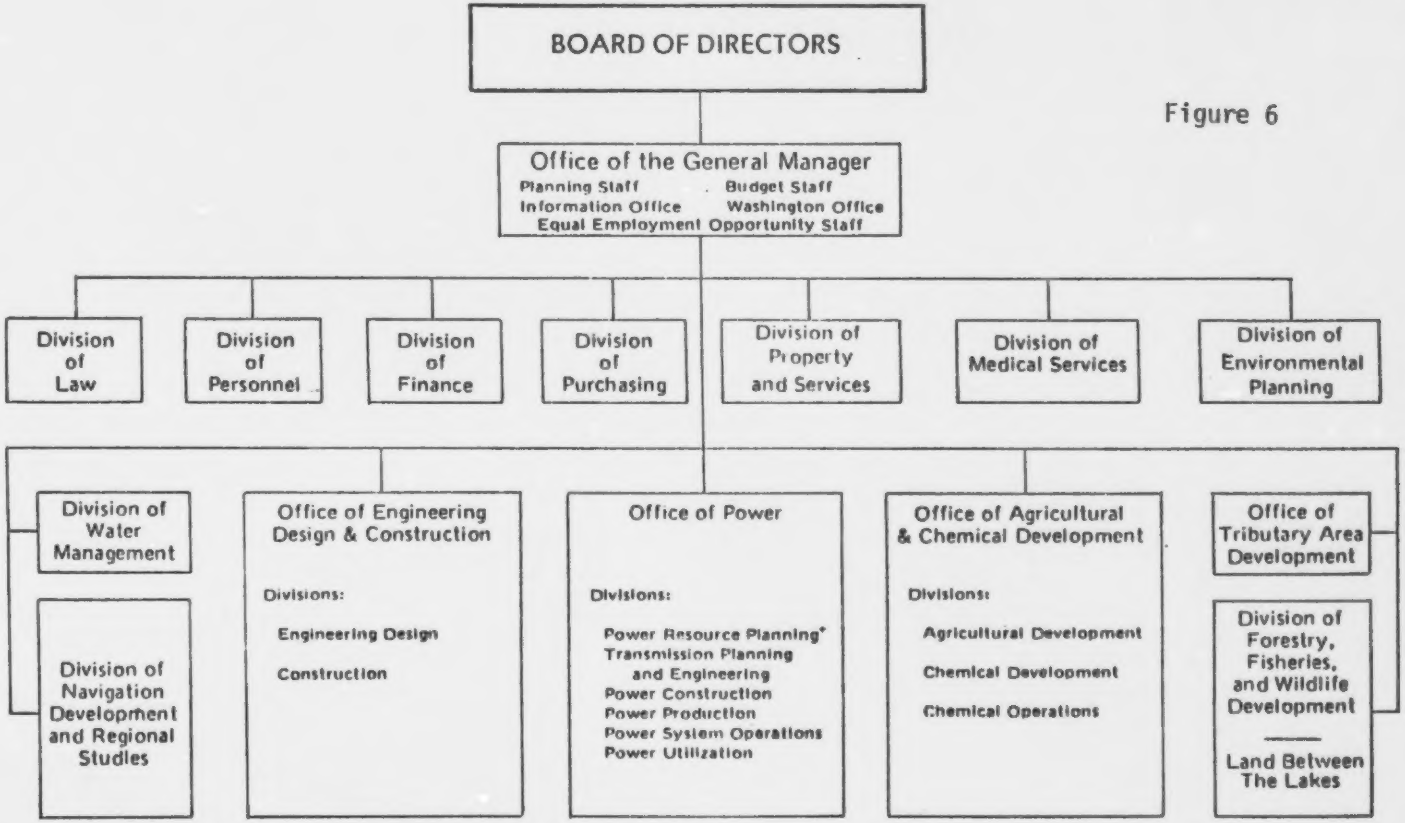
The Board of Directors, established under the TVA Act, is vested with all the powers of the Corporation. The Board establishes general policies and programs, reviews and appraises progress and results, approves projects and specific items, approves the annual budget, and establishes the basic organization through which programs and policies are executed. The General Manager is the principal TVA administrative officer, who serves as liaison between the Board and the offices and divisions in the handling of matters of Board concern. The General Manager is also responsible for coordinating the execution of programs, policies and decisions which the Board approves or adopts. Duties are assigned to ten divisions and five offices, as depicted in the organizational chart on the following page. Functions of these components can be found in Attachment II.

TVA presently owns 29 power dams and controls the power generation from eight Corps of Engineers dams and 12 small dams in East Tennessee owned by the Aluminum Company of America (Alcoa). Twelve steam plants are operated, run primarily by coal, that account for the major generation of the system at the present time. TVA operates one two-unit nuclear plant at Browns Ferry in North Alabama. To meet what the agency believes will be the future demand for electricity within its territory, almost as much additional capacity is under construction or planned as is now in service, a total of almost 21 million kilowatts, most of it nuclear. In addition to Browns Ferry, where a third unit is scheduled to go into commercial operation in 1977, four more are under construction, to be completed by 1981, and three more beyond this are being planned. Upon completion of all facilities, 19 nuclear units will be operable (see Attachment III).

In 1936, TVA began a continuing program of water quality surveys that identify pollution, problems and needed improvements, working closely with state governments. The program provides treatment for wastes from its own facilities, and uses its shoreline landrights to require new lakeshore industries to provide adequate wastewater treatment. TVA also provides technical help on water supply and wastewater disposal to various government agencies and organizations. In 1973, TVA initiated a water quality monitoring network to determine long-term trends in water quality conditions at selected "key" locations in the Valley. The purpose of this network is to provide up-to-date information about water quality conditions throughout the Tennessee River basin for use within TVA, by other Federal agencies, and by state and local governmental agencies, private industries, and the general public.

ORGANIZATION OF THE TENNESSEE VALLEY AUTHORITY

Figure 6


BOARD OF DIRECTORS
Office of the General Manager
Planning Staff
Budget Staff
Information Office
Washington Office
Equal Employment Opportunity Staff
Division of Law
Division of Personnel
Division of Finance
Division of Purchasing
Division of Property and Services
Division of Medical Services
Division of Environmental Planning
Division of Water Management
Division of Navigation Development and Regional Studies
Office of Engineering Design & Construction
Divisions:
Engineering Design
Construction
Office of Power
Divisions:
Power Resource Planning*
Transmission Planning and Engineering
Power Construction
Power Production
Power System Operations
Power Utilization
Office of Agricultural & Chemical Development
Divisions:
Agricultural Development
Chemical Development
Chemical Operations
Office of Tributary Area Development
Division of Forestry, Fisheries, and Wildlife Development
Land Between The Lakes

TVA began its program of air quality research and control in the early 1950's, as it began shifting to coal-burning plants to meet the region's growing power demands. At that time, mechanical collectors were utilized, but in the late 1960's the agency began installing more efficient electrostatic precipitators designed to remove 90 to 99 percent of the fly ash produced. TVA has continued to install high efficiency precipitators at all of its coal-fired plants. In addition, a sulfur dioxide scrubber is under construction at one of TVA's coal-fired plants as a demonstration project. TVA has continued the development of an alternative method of meeting ambient air standards for sulfur dioxide around its coal-fired steam plants. This control system uses a combination of tall stacks and meteorological forecasting to reduce emissions temporarily during unfavorable dispersion conditions with the use of low-sulfur coal or a reduction in operation. The U.S. Environmental Protection Agency and some state regulatory agencies prefer a constant limitation approach, which would require some combination of chemical scrubbers, low sulfur coal, and coal washing. At the present time, only two of TVA's coal-fired plants are meeting federal air standards, and in 1976 the Authority lost a court suit against EPA over regulations on sulfur dioxide emissions from the remaining noncomplying plants. TVA officials claim that it is impossible for the plants to meet clean air standards within the three-year period ordered by EPA. TVA has urged Congress to relax the standards and at the same time has sought low-sulfur coal. TVA officials have placed the cost of meeting the orders at $375 million, while EPA claims the utility's cost will be about $225 million.

Since 1965, TVA has included land reclamation requirements in contracts for coal to be produced by surface mining. The Authority now requires an approved mining and reclamation plan before a coal contract is awarded. Other requirements include water runoff and erosion control measures, hydraulic seeding of grasses for quick ground cover, planting of trees and shrubs for planned land use after mining, restricting the scale of mining in relation to the steepness of the land, and other measures. Surface mining is prohibited in designated wilderness areas or scenic areas, and anywhere that adequate reclamation cannot be obtained. During 1976, TVA began work on a five-year "orphan" mine reclamation project in cooperation with state agencies in Alabama, Kentucky, Tennessee and Virginia. Subject to continued Federal funding, this demonstration ultimately will involve 80,000 acres plus 6,700 acres of haul roads.

Since 1969, TVA has offered technical assistance to Valley communities in the location and design of sanitary landfills and garbage collection systems. Within six years, the agency provided 56 plans for sanitary landfill construction to local Valley communities. Over 40 collection systems were planned and implemented during this time period. TVA also provided technical assistance for a combination solid waste incinerator-heat recovery plant to be constructed in Lewisburg, Tennessee, and has investigated the possibilities of a regional system to process solid wastes. Such a system could recover valuable materials such as ferrous metals, aluminum and glass, while producing a fuel product suitable for burning in TVA coal-fired plants or other energy-using installations.

In 1976, over $34 million was spent on power-related research and developments in TVA. Of the total, $27 million was funded by TVA. The Electric Power Research Institute (EPRI), the Environmental Protection Agency (EPA), and the Energy Research and Development Administration (ERDA) contributed a total of

$7 million for cooperative research efforts carried out by TVA. The Authority continued to participate in the Clinch River Breeder Reactor Project to be built at Oak Ridge, Tennessee, sponsored by the U.S. Government and the electric utility industry with principal management control by ERDA. Increased research and development funds have been committed in the areas of air and water quality. For example, an industry-TVA cooperative design study and pilot-plant testing of an advanced concept for electrostatic precipitation, which controls particulate matter in stack gases, was started in 1976. TVA is participating with ERDA and the University of Tennessee in the construction and operation of a solar house near the university's Knoxville campus. The house will be used to study the feasibility of residential solar heating and cooling in the TVA area. TVA experimenters at Muscle Shoals, Alabama have found promising results in using warm water, simulating water discharged from power plants, to heat and cool a greenhouse. A larger demonstration greenhouse will be operated at Browns Ferry nuclear plant, along with other uses of warm water from the plant.

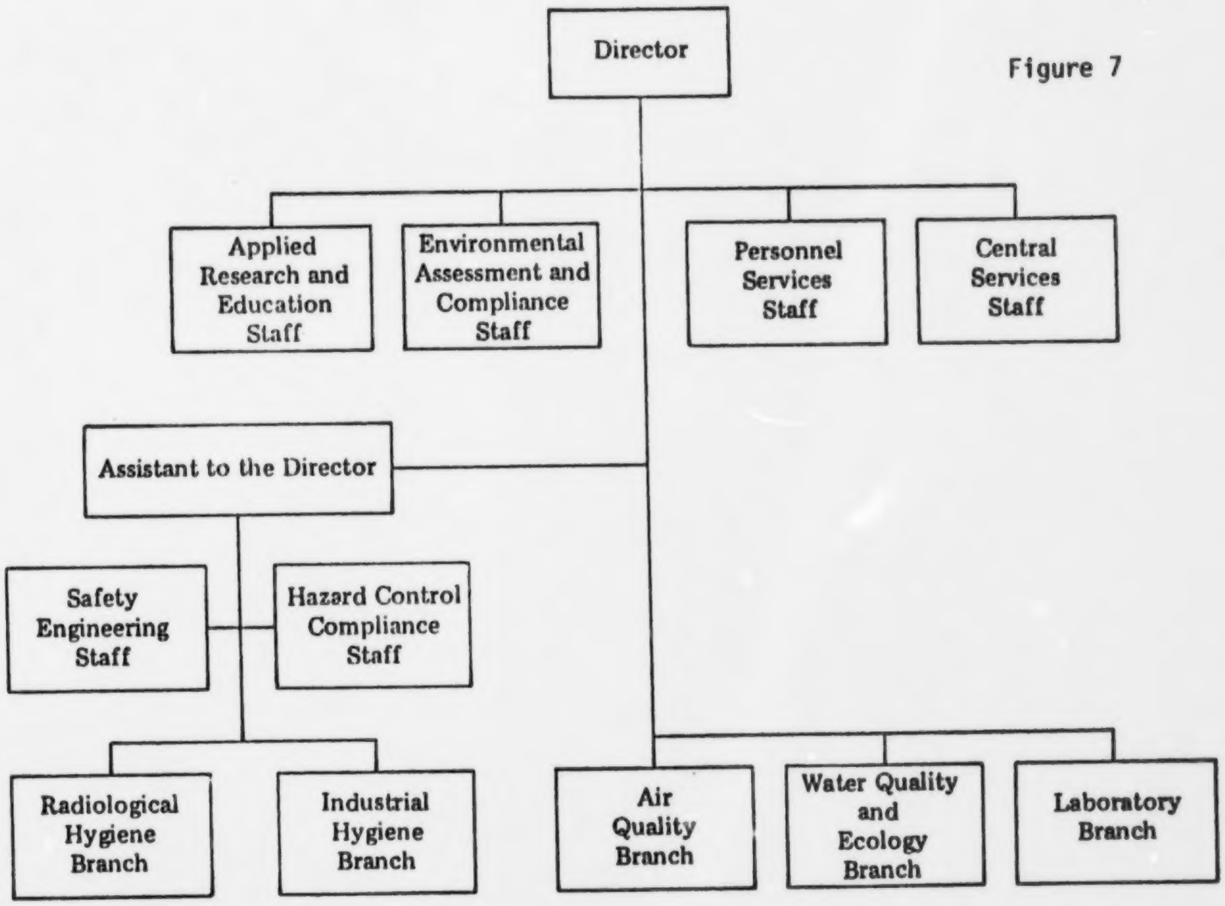
B. Workforce Profile

Within all of its offices and divisions, TVA employs approximately 17,000 persons. Nearly every component of TVA carries out activities relating to environmental pollution control in some manner. TVA officials estimate that approxiamtely 90-95% of all environmental control activities take place in the Division of Environmental Planning (DEP). TVA's Organizational Bulletin of February 29, 1976 cites the functions of this Division as follows:

> The Division of Environmental Planning recommends, develops, coordinates and carries out programs and activities related to TVA's interests in the environmental quality of the region and in occupational safety and health features of TVA facilities. It reviews and evaluates the occupational safety and health

DIVISION OF ENVIRONMENTAL PLANNING

Figure 7


Director
Applied Research and Education Staff
Environmental Assessment and Compliance Staff
Personnel Services Staff
Central Services Staff
Assistant to the Director
Safety Engineering Staff
Hazard Control Compliance Staff
Radiological Hygiene Branch
Industrial Hygiene Branch
Air Quality Branch
Water Quality and Ecology Branch
Laboratory Branch

> considerations and environmental impact of programs and activities proposed and carried out by all offices and divisions of TVA and provides technical guidance, assistance and services as needed to assure the appropriate environmental protection and hazard control features are planned and implemented. It conducts environmental and occupational field monitoring, studies, and investigations at TVA installations. It provides hazard control data and technical assistance to state and local agencies. It coordinates, administers, and conducts environmental and occupational safety and health research and demonstration projects carried out by TVA alone and in cooperation with other agencies and organizations. It serves as TVA's liaison with other governmental agencies concerned with environmental planning and occupational safety and health.

The Radiological Hygiene Branch, located in Muscle Shoals, Alabama, evaluates plans for nuclear facilities and develops radiological hygiene standards and procedures for use at planned and operating nuclear plants. It provides on-site health physics staff and conducts environmental radioactivity monitoring at nuclear power plant sites. It maintains a radioanalytical laboratory and dosimetry facilities to analyze environmental biological samples and to record and evaluate personnel radiation exposure. Finally, the Branch coordinates the TVA Radiological Emergency Plan and maintains liaison with Federal, State and local agencies on radiological matters. According to a DEP personnel computer printout, dated July 3, 1976, this Branch employs 66 persons, as depicted in the following table, by educational background:

TABLE XIX

TVA DIVISION OF ENVIRONMENTAL PLANNING

Radiological Hygiene Branch
Current (1976) Staffing Level

Position	1976
Bachelor Degree or higher:	
Engineer	6
Chemist	8
Physicist	9
Health Physicist	3
Other	8
Associate Degree	2
High School +	14
High School	16
TOTAL	66

Each nuclear plant is provided with one professional health physicist. In addition, on the average, each operating nuclear plant would be staffed with approximately nine technicians for radiation control, that have associate degrees or the equivalent and have participated in specialized training offered by TVA. These persons are included in overall staffing level figures for DEP's Radiological Hygiene Branch.

The Water Quality and Ecology Branch of DEP, located in Chattanooga, Tennessee coordinates TVA's water quality management plans and activities, evaluates and assesses water quality aspects of proposed new projects, and reports on water quality aspects and activities. It conducts studies and field investigations to identify and evaluate the interdependence of water resource development and water quality, and seeks to maintain accurate information on water quality in the Valley. The Branch participates in negotiations with prospective industries with regard to plant locations in the Valley involving TVA land or landrights, advises as to waste treatment requirements, and reviews final plans for approval by TVA. Assistance is provided to other TVA components in planning, designing and operating industrial waste treatment and disposal facilities. Biological and ecological studies are performed, and the Branch assures that TVA solid wastes and hazardous wastes are disposed of properly. Technical assistance is also offered in the field of solid waste.

According to the same computer printout, this Branch employes 170 personnel, as follows:

TABLE XX

TVA DIVISION OF ENVIRONMENTAL PLANNING

Water Quality and Ecology Branch
Current (1976) Staffing Level

Position	1976
Bachelor Degree or higher:	
Engineer	31
Biologist	33
Chemist	7
Other	38
Associate Degree	2
High School +	44
High School	15
TOTAL	170

The Air Quality Branch of DEP at Muscle Shoals, Alabama, coordinates TVA's air quality management program, advises on plans for air quality control at all TVA installations, evaluates air quality features of proposed new projects and reports on air quality management activities and progress. The Branch plans, develops, implements, and provides on-site staff for operating sulfur dioxide limitation programs at coal-fired power plants for controlling ambient air quality. Planning and development of applied research is carried out, as well as the establishment of air, meteorological and ecological monitoring systems. The Branch also negotiates with prospective industries regarding plant locations in the Valley involving TVA land or landrights.

Staffing levels for this Branch for July, 1976 are as follows:

TABLE XXI

TVA DIVISION OF ENVIRONMENTAL PLANNING

Air Quality Branch

Current (1976) Staffing Level

Position	1976
Bachelor Degree or higher:	
Engineer	8
Meteorologist	13
Chemist	17
Physicist	5
Other	51
Associate Degree	1
High School +	35
High School	38
TOTAL	168

The Office of Engineering Design and Construction, an entity separate from the Division of Environmental Planning, located in Knoxville, Tennessee, participates in the planning and provides or obtains the architectural treatment, engineering design, and construction of most of the permanent structures and permanent engineering works which are authorized to be built by the TVA program. Personnel in this office design, procure and construct pollution control equipment installed in TVA facilities. For mechanical aspects, approximately 20 persons, principally engineers, are involved in the design and procurement of equipment. A greater number of engineers and technicians is involved in the preparation of construction drawings. For the electrical aspects, approximately six associate engineers and eleven engineers work in design.

In addition, approximately 24 engineers and 16 associate engineers are involved in construction drawings. Officials estimate that approximately 200 persons in the office currently participate to some extent in environmentally-related projects, consisting mainly of engineers, technicians and draftspersons. For engineering work, the Office seeks civil engineers with experience in the field of those with degrees in some aspect of environmental engineering. Those at the technician level are not required to have had previous environmental experience or training, but should have a background in engineering technology.

The Division of Water Management, also a separate entity, and located in Knoxville, Tennessee, provides a comprehensive program of water resources management in the Tennessee Valley region which includes flood damage abatement and the scheduling of releases from all TVA-owned and TVA-operated reservoirs. This Division also performs specialized services, one of which is the design, operation and maintenance of air and water monitoring systems. Data are gathered and forwarded to the Division of Environmental Planning. Administrators within the Division estimate that there are 140 people spending about two-thirds of their time in all phases of the monitoring program. Forty are college graduates with degrees in the fields of electrical engineering, civil engineering, meteorology or mathematics. Fifty are skilled technicians with service training, vendor training, TVA training and on-the-job training. Fifty are classified as engineering aides with varying levels of education from high school to several years of college. Their training consists of on-the-job training and specialized college-level technical courses.

In sum, within these three components of TVA, there are an estimated 744 persons spending full- or part-time in environmental control activities. In the Division of Environmental Planning, in the air, water and radiation components, there are approximately 404 persons out of the total of 525 in DEP, consisting of 45 engineers, 95 scientists, 98 with associate degrees or some college experience, and 69 with high school educations. An additional 97 have at least a bachelor's degree in such varied fields as agriculture, business administration and political science. In the office of Engineering Design and Construction, approximately 200 persons participate in the environmental field, consisting of engineers, engineering technicians and draftspersons. The office of Water Management estimates that 140 persons are involved in air and water monitoring, consisting of engineers, scientists and technicians.

C. Workforce Projections

According to administrators within the Division of Environmental Planning, this office as a whole expects to grow by approximately 15% in each of the next two years, by approximately 10% in 1979, and by 5% in the years 1980 and 1981. Approximately 70% of the overall growth will occur in the radiological hygiene field, while the remainder of the growth will be in a variety of areas, including research and development, air and water pollution control, solid waste, data management, industrial hygiene, and consumer education. According to sources, an estimated 8% of the total workforce increase will stem from accelerated activities in the search for alternate energy sources and in conservation efforts.

DEP officials indicate that a similar overall growth pattern may be exhibited in the three branches under study. In this case, the Radiological Hygiene Branch will account for approximately 70% of this overall increase, primarily due to the planned additions of four operating nuclear plants within the next five years, and three more within the following five years. Twenty percent of the increase has been projected to occur within the Water Quality and Ecology Branch, and ten percent in the Air Quality Branch. Increases in the Water Quality Branch will primarily be due to stepped-up research and development efforts. Smaller increases are projected for air quality control because of the nature of the tasks involved in meeting federal guidelines. The usage of low sulfur coal would not cause workforce impacts, and if additional equipment is installed, much of the work would be performed by private consulting firms. If TVA uses a "continuous" emission control program in the future, as EPA suggests, the number of persons required for air monitoring would decline. However, after the installation of equipment, environmental effects must be assessed.

The following table depicts projected staff growth rates in these three Branches, as forecasted by professionals in the field.

TABLE XXII

TVA DIVISION OF ENVIRONMENTAL PLANNING

Workforce Projections to 1982 (est.)

Branch	1976	1977	1978	1979	1980	1981	% Turnover	% annum growth (average)
Radiological Hygiene	66	109	157	195	216	237		31%
Air Quality	168	174	181	187	190	193		3%
Water Quality & Ecology	170	182	196	207	213	219		5%
TOTAL	404	465	534	589	619	649	8%	11%

Within radiation control, nuclear physicists and health physicists will be required for the most technical areas of activity, while needs will also increase for subprofessionals such as health technicians with radiation backgrounds for monitoring radiation levels inside and outside plants. A need will also occur for administrators with backgrounds in the field, although it would be helpful for other DEP professionals to have had administrative experience. Needs will also occur for specialists in public relations, with enough background in the field to present information and ideas to the public.

In the water quality program, staff will be needed to expand research and development programs, to monitor status and cycles of water in the Tennessee Valley and to develop alternative ways to handle solid waste. The persons required could stem from broader-based environmental programs, with a combination of environmetal systems type engineers, scientists and technicians.

The specific needs in air quality control will be at least partially dependent upon decisions reached regarding TVA's method of meeting air pollution standards. Increased staff will probably include engineers, scientists and technicians.

DEP also projects additional staffing needs for work relating to energy conversion/conservation, though possibly within other components of the Division. Needs will occur for persons that understand current processes and techniques of conservation. Persons with backgrounds in a combination of geology and land use are expected to be required also, for work relating to coal efficiency and sulfur emission control. In addition to the above, persons with broad backgrounds in fields such as physics and meteorology will be required. Within the next five years, the number of persons working with computers in DEP is expected to increase from zero to ten. Finally, increased needs are expected to occur for industrial hygienists, although these persons are very difficult to recruit, to safeguard TVA plant workers against exposure to toxic substances. To a lesser degree, safety engineers might be also required for this function.

Within the office of Engineering Design and Construction, officials have indicated that a decline will not occur in the numbers of persons involved in environmental work, and increases may occur. Specific numbers, however, have not as yet been determined. At least five persons with experience dealing with electrostatic precipitators will be required in the mechanical area, such as civil engineers or engineers with master's degrees in some area of environmental engineering. Additional technicians and draftspersons will also be required in this area for constructing drawings. Increased numbers of personnel will probably also be required for electrical design, procurement and drawing. The Office as a whole expects to see increased needs for persons highly skilled and trained in all engineering fields, including environmental, electrical, mechanical engineers. Those engineers with experience in nuclear power plant design will be in significant demand, though this type of person is not readily available. Technicians will continue to advance to higher levels, so openings are projected to occur at this level. In addition, electrical monitoring of coal-fired plant cooling towers will require persons with backgrounds in computers that have an understanding of the incoming data, and what it represents.

The Division of Water Management does not expect to require a significant increase in staff. Projections through 1982 include the additions of a meteorologist and an instrument chemist.

D. Training and Certification

During the latter portion of 1976, the Division of Environmental Planning hired a training officer. At the time of the interview, this officer was reviewing files to ascertain the types of training opportunities that DEP employees had previously been involved in. This process had not yet been completed, but courses were being divided into three types: a) qualifying courses, or those required by an employee to fulfill job functions, b) developmental courses, or those intended to improve job skills, and c) on-the-job training. Preliminary tabulations have revealed that clerical employees have received the least amount of training. Other employees have been receiving a significant amount of qualifying and developmental training, from sources inside and outside TVA. These have included many university courses, including managerial and technical areas. Little data have been found regarding on-the-job training, as this activity is usually constructed informally and often goes unrecorded.

After the training officer has completed the survey, a training program will be developed. Employees desiring training will be advised of opportunities, and arrangements will be made for follow-through. Evaluations of educational/training programs will also be carried out, based upon employee feedback. The training officer anticipates becoming, in essence, a career counselor when the program is fully developed. Previous to this time, employees desiring training made requests of their supervisors who, in turn, requested written approval from the Division director.

Training to technicians in the Radiological Hygiene Branch that are or will be located in nuclear facilities is offered by the Branch's training staff in Muscle Shoals. Training lasts approximately one year, the first six months of which is formal training covering TVA rules and regulations, job techniques and operational procedures. The final six months is spent by training staff in providing on-the-job training to these persons at their own employment sites. Approximately ten persons per year are being trained in this manner.

Personnel within the office of Engineering Design and Construction rely to a large extent upon trade magazines to keep abreast of new technical developments within the fields. Vendors of pollution control equipment also demonstrate new-types of products to staff. No more than a dozen higher-level persons in the office attend environmentally-related courses per year. Courses attended include those offered by universities and private industries. The University of Tennessee offers a concentrated short course annually during "Tennessee Industries Week", and personnel from the Office usually participate. Administrators feel that as the office tends to hire very experienced people, training needs only occur for keeping up with the state of the art.

The Division of Water Management also has the policy of hiring personnel with sufficient training and experience for the level of work required. Training that is available to employees includes selected vendor training and in-house equipment training.

E. Career Potential

The Division of Environmental Planning expects growth to occur in the number of engineers, scientists and technicians. The greatest growth will be in radiological hygiene, and the number of health physicists, nuclear physicists and radiation technicians is expected to increase more than threefold in the next five years. For other environmental and energy-related areas, a need for persons with backgrounds in interrelated disciplines has been stressed, particularly for research and development activities in the areas of water quality, potable water and solid waste. Diciplines to be required include mechanical, electrical, nuclear and environmental engineering, geology, land use, agriculture, physics, and meteorology. Increased monitoring activities will also require additional technicians, preferably with vocational/technical training. Persons with backgrounds in techniques of energy conversion and conservation will be in great demand, probably requiring selected above-mentioned disciplines in their educational backgrounds.

Also within DEP, requirements are expected to occur for industrial hygienists, and to a lesser extent, for safety engineers. Persons with expertise in public relations and basic understandings of the environmental and energy fields will be required, as will person with backgrounds in data management and computer techniques. This growth, coupled with an 8% turnover rate, should provide opportunities for persons from a wide array of backgrounds.

Few new types of backgrounds are expected to be required within the Office of Engineering Design and Construction, although persons with experience working with electrostatic precipitators will be in demand, probably civil engineers or mastered environmental engineers. Favorable opportunities should also exist for engineers trained in nuclear power plant design. Increased requirements are occurring for skilled data management/computer personnel. Beyond this, opportunities will continue to exist for skilled engineers from a variety of fields, for draftspersons and for engineering technicians. The latter two groups need not have had previous environmental training.

The Division of Water Management anticipates creating only two new positions within the next five years, for a meteorologist and an instrument chemist. Other personnel currently involved in environmental work include electrical engineers, civil engineers, meteorologists, mathematicians, technicians and aides. As turnover for this group is estimated at one to two percent, career opportunities for those wishing to enter this Division will probably be minimal.

F. Conclusion

Environmentally related functions are carried out in nearly every Office and Division within TVA. Three components, the Division of Environmental Planning, the Division of Water Management, and the Office of Engineering Design and Construction were focused upon in this report, representing an estimated 95% of all direct environmental efforts carried out in TVA.

The Division of Environmental Planning, which is the major coordinator of environmental affairs within TVA, expects an approximate overall growth rate of 60% in the next five years in its water quality, air quality and radiological hygiene branches. The major portion of this growth will be in radiological hygiene, for minimizing radiation hazards due to operating and scheduled nuclear plants. The remainder of this growth will be for such programs as air and water pollution control, research and demonstration in energy conversion/conservation and air and water quality, solid waste and other areas. Other increases in this Division will be in public relations, industrial hygiene and data management.

The Office of Engineering Design and Construction expects increases in staffing, to require additional engineers, engineering technicians and draftspersons. Engineers with experience working with electrostatic precipitators and those experienced in the design of nuclear facilities will be in demand.

Two new positions are expected to be required in the Division of Water Management in the next five years for air and water monitoring functions. These include a meteorologist and an instrument chemist.

Technical upgrade training appears to be available to employees at the level required. In most cases, administrators attempt to hire persons with backgrounds adequate to carry out required job duties, and updates in new technologies are the main requirements. The Division of Environmental Planning, however, is in the process of developing a training program for its personnel.

In sum, environmental opportunities should exist for persons in a wide array of fields and at diversified professional/technical levels. Further, these opportunities will exist throughout the major portion of the Tennessee Valley.

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Attachment I

ORGANIZATION BULLETIN
Tennessee Valley Authority
Office of the General Manager

1 TVA

ORGANIZATION OF THE TENNESSEE VALLEY AUTHORITY

The Board of Directors approved the following statement of organization for the Tennessee Valley Authority to be effective January 4, 1976. It supersedes the organization statement effective July 1, 1975.

The Board of Directors, under the TVA Act, is vested with all the powers of the Corporation. The Board establishes general policies and programs; reviews and appraises progress and results; approves projects and specific items which are of major importance, involve important external relations, or otherwise require Board approval; approves the annual budget; and establishes the basic organization through which programs and policies are executed.

The General Counsel advises the Board on legal matters. He, or the representative he designates to act in his absence, serves as Secretary to the Corporation.

The General Manager is the principal TVA administrative officer. He serves as liaison between the Board and the offices and divisions in the handling of matters of Board concern, and is responsible for coordinating the execution of programs, policies, and decisions which the Board of Directors approves or adopts. He brings before the Board matters which require its consideration or approval; assists the Board in presenting the TVA budget to the Office of Management and Budget and to Congress; affirms to the Board the adequacy of staff coordination and contribution in matters presented for its consideration, including judgments relating to broad public consequences, social and economic effects, and planning and program direction; interprets the Board's instructions to the offices and divisions; originates or approves administrative controls to ensure integrated execution of the total TVA program; and reports to the Board on overall efficiency, effectiveness, and economy of TVA operations.

The General Manager assigns duties and makes delegations to the TVA offices, divisions, and staffs in their execution of programs and policies which the Board of Directors adopts, subject to such controls as it may establish. He reviews and approves major TVA management methods, major organization changes within offices and divisions, and major staff appointments, and recommends to the Board basic changes in the TVA organization. He is responsible for ensuring that appropriate matters are presented in coordinated form to the Board at the proper time and that the Board has pertinent related information. He provides for the formal definition and communication of TVA programs, policies, procedures, and continuing delegations of authority and responsibility.

The Office of the General Manager includes the Planning Staff, the Budget Staff, the Information Office, the Equal Employment Opportunity Staff, the Washington Office, the Power Financing Officer, and such other assistants as the General Manager may require to perform specialized duties or to aid him in expediting, coordinating, and disposing of current business. The functions of the above groups are set out in the Organization Bulletin, "Office of the General Manager" (I GENERAL MANAGER).

January 4, 1976

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I TVA

The Division of Finance formulates, recommends, administers, and evaluates policies related to accounting, auditing, financial reporting, and the handling of TVA funds; establishes systems of accounting and internal control, including accounting controls over TVA property and other assets; develops related instructions and procedures; and advises and assists on matters pertaining to these functions. It performs accounting and administrative work for the TVA Retirement System.

The Division of Law handles all litigation, legal proceedings, claims, and other legal problems relating to TVA's activities; advises and assists on legislative matters in which TVA has an interest; gives legal advice, opinions, and assistance; and prepares or approves and construes all documents affecting TVA's legal relationships.

The Division of Personnel formulates, recommends, administers, and evaluates policies in the field of personnel administration, including those related to recruitment, selection, classification, compensation, and training of personnel, union-management relations, organization, administrative relations, personnel management information, and related aspects of personnel administration; conducts negotiations with unions representing employees; develops personnel standards and procedures; and advises and assists in the handling and execution of matters and actions related to TVA personnel administration.

*The Division of Property and Services develops, recommends, and carries out plans, policies, and activities related to acquisition, transfer, and disposal of real property; administration of TVA lands not managed by program divisions; operation and upkeep of dam reservations; site planning and landscape architectural services; property protection and law enforcement; and visitor information at appropriate TVA properties. It provides specialized services on TVA lands and reservations for other programs when in the interest of efficiency and economy. It formulates, recommends, administers, and evaluates policies related to the provision of computing and systems development services; transportation services; coordination of nonmilitary defense measures, employee housing assistance, and offices services, and analyses of office systems; and develops related standards and procedures, and advises and assists in their application and use.

The Division of Purchasing formulates, recommends, administers, and evaluates policies relating to the procurement, shipping, transfer, and disposal of equipment, materials, supplies, and services, except personal services; and issues instructions and advises and assists on matters related to the application of these policies.

The Office of Agricultural and Chemical Development formulates, recommends, and carries out plans, policies, and programs for research in and development of experimental new and improved forms of fertilizers and processes for their manufacture; for testing and demonstrating the value and best methods of fertilizer use as an aid to soil and water conservation and to improved use of agriculatural and related resources; for developing, operating, and maintaining facilities to serve as a national laboratory for the dual purposes of research in chemistry and chemical engineering in the development and production of experimental fertilizers and the design and testing of improved manufacturing processes, and for the production and provision of basic chemical materials and services in the munitions field essential to national defense; for readjustment of agricultural areas affected by TVA operations; and for related activities having to do with the management and use of agricultural resources and with national defense.

*Revision

--January 4, 1976

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The Office of Engineering Design and Construction participates in the planning and provides or obtains the architectural treatment, engineering design, and construction of all permanent structures and permanent engineering works which are authorized to be built in the TVA program, in accordance with the requirements determined by the offices and divisions having program responsibilities for such structures and works, except for power transmission, distribution, and communication facilities and switchhouses at substations not adjacent to generating stations: and provides other engineering, architectural, and construction services as feasible and economical.

The Division of Environmental Planning recommends, develops, coordinates, and carries out programs and activities related to TVA's interests in environmental quality of the region. It reviews and evaluates the environmental impact of programs and activities proposed and carried out by other offices and divisions and provides technical guidance and assistance as needed to assure that appropriate environmental protection features are planned and implemented. It conducts field monitoring and environmental quality studies and investigations at TVA installations. It provides environmental data and technical assistance to state and local agencies. It coordinates and administers environmental research and demonstration projects carried out by TVA in cooperation with other agencies and organizations. It serves as TVA's liaison with other governmental agencies concerned with environmental planning and protection. In collaboration with other divisions, it develops and applies programs to assess and control potential hazards in the work environment of TVA employees.

The Division of Medical Services develops, recommends, and executes plans and policies related to the health of employees and of the public affected by TVA activities, and to TVA's interests in community health education and health planning. It participates in medical research and development activities, demonstrations, and other cooperative activities with Federal, state, and local agencies and other organizations.

The Office of Power develops, recommends, and appraises objectives, plans, policies, and programs, and carries out approved policies, programs, and activities for the generation, transmission, and utilization of electric power; forecasts future needs of the power program and plans means and methods of meeting those needs; and cooperates with other TVA organizations in carrying out TVA's multiple-purpose programs involving power activities.

The Office of Tributary Area Development administers TVA's interests in comprehensive activities designed to obtain maximum economic progress in tributary areas of the Tennessee Valley region. It works with state and Federal agencies and with local governmental and citizen groups in organizing for, planning, and carrying out unified resource development programs in individual areas. It administers contracts for related studies and demonstrations. It coordinates the participation of other TVA offices and divisions in all stages of tributary area planning and development.

*The Division of Forestry, Fisheries, and Wildlife Development formulates, recommends, and conducts investigative and development programs in forestry, fisheries, and wildlife, directed toward maximum sustained production and use of these resources for their contribution to the regional economy and environment. It plans and administers Land

*Revision

Between The Lakes to demonstrate social, economic, and other benefits in unified development and management of these and other natural resources for large-scale outdoor recreation and environmental education uses. It develops, recommends, coordinates, and carries out plans, policies, and activities related to development of Valley recreation resources. It maintains cooperative relationships with Federal, state, and other appropriate agencies and industries concerned with these resources.

The Division of Navigation Development and Regional Studies develops, recommends, and carries out plans, policies, and programs for the navigation engineering development of the Tennessee River system and for its full and effective use in development of the region; conducts studies and research and advises and assists the General Manager, offices, and divisions on social, economic, and governmental relationships, and regional planning problems and opportunities of importance to development of the region; and performs related activities.

The Division of Water Management provides a comprehensive program of water resources management in the Tennessee Valley region which includes flood damage abatement and the scheduling of releases from all TVA-owned and TVA-operated reservoirs in accordance with the TVA Act, taking into consideration all essential objectives of water resources management such as flood control, navigation, power production, water quality management, water supply, and recreation. It provides specialized services which include the development and operation of environmental monitoring systems, engineering geologic investigations, land approvals, topographic mapping, engineering surveying, engineering laboratory research and testing, and hydrologic and hydraulic research activities.

Attachment II

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GENERATING CAPACITY ON JUNE 30, 1976

In Service

TVA Hydro Plants	*No. Units*	*Installed Capacity - kW*
Apalachia	2	78.900
Blue Ridge	1	20.000
Boone	3	75.000
Chatuge	1	10.000
Cherokee	4	129.300
Chickamauga	4	111.000
Douglas	4	115.000
Fontana	3	238.500
Fort Loudoun	4	135.590
Fort Patrick Henry	2	36.000
Great Falls	2	31.860
Guntersville	4	101.700
Hiwassee	2	117.100
Kentucky	5	175.000
Melton Hill	2	72.000
Nickajack	4	100.350
Norris	2	100.800
Nottely	1	15.000
Ocoee #1	5	18.000
Ocoee #2	2	21.000
Ocoee #3	1	28.800
Pickwick	6	220.040
South Holston	1	35.000
Tims Ford	1	45.000
Watauga	2	50.000
Watts Bar	5	153.300
Wheeler	11	356.400
Wilbur	4	10.700
Wilson	21	629.840
Total	109	3.231.180

TVA Coal-Fired Plants	*No. Units*	*Installed Capacity - kW*
Allen	3	990.000
Bull Run	1	950.000
Colbert	5	1.396.500
Cumberland	2	2.600.000
Gallatin	4	1.255.200
John Sevier	4	846.500
Johnsonville	10	1,485.200
Kingston	9	1,700.000
Paradise	3	2.558.200
Shawnee	10	1,750.000
Watts Bar	4	240.000
Widows Creek	8	1.977.985
Total	63	17,749.585

TVA Nuclear Plants	*No. Units*	*Installed Capacity - kW*
Browns Ferry	2	2.304.000

TVA Combustion Turbine Plants	*No. Units*	*Installed Capacity - kW*
Allen	20	620.800
Colbert	8	476.000
Gallatin	4	325.200
Johnsonville	16	1.088.000
Total	48	2.510.000
Alcoa Dams (12)		423.715
Corps of Engineers Dams (8)		853.000
Total System in Service		27.071.480

Under Construction or Planned

Browns Ferry Nuclear Unit 3 Scheduled Commerical Operation—1977	1	1.152.000
Sequoyah Nuclear Scheduled Commercial Operation—1978-1979	2	2.441.160
Raccoon Mountain Pumped Storage Scheduled Commercial Operation—1978	4	1.530.000
Watts Bar Nuclear Scheduled Commercial Operation—1979-1980	2	2.539.800
Bellefonte Nuclear Scheduled Commercial Operation—1980-1981	2	2.664.000
Proposed Hartsville Nuclear Scheduled Commercial Operation—1983-1984	4	5.148.000
Proposed Phipps Bend Nuclear Scheduled Commercial Operation—1984-1985	2	2.574.000
Proposed Yellow Creek Nuclear Scheduled Commercial Operation—1985-1986	2	2.678.000
	19	20.726.960

(Taken from 76 Annual Power Report, Tennessee Valley Authority)

Selected Post Secondary Institutions With Formal Environmental Energy Programs

On the following pages are descriptions of two environmental curricula offered by academic institutions in Tennessee. Chattanooga State Technical Community College offers an associate degree in Chemical and Environmental Technology. East Tennessee State University in Johnson City offers B.S. and M.S.E.H., degrees in Environmental Health. The graduate program is multidisciplinary and students may choose environmental health administration or any of several specialties which include, Air Pollution, Water Pollution, Occupational Health, Solid Waste Management and General Environmental Health. The University also offers a Public Health Sanitation School and Certificate.

The University of Tennessee at Knoxville offers bachelor, master and doctorate level degrees in environmental engineering. Courses are offered in the fields of air and water pollution, water supply, water resources and other associated areas. The University of Tennessee at Nashville allows students to earn an undergraduate and graduate degree in Civil Engineering. Both programs involve a spectrum of environmental courses.

Austin Peay State University offers a bachelor's degree in Environmental Science, dealing chiefly with environmental pollution and aquatic ecosystems.

The Department of Environmental Engineering and Policy Management at Vanderbilt University offers two bachelor degrees in environmental studies: the Bachelor of Engineering in Environmental and Water Resources Engineering and the Bachelor of Science in Environmental Science. Graduate work on the master and doctorate levels is available in the former program. An M.S. degree is offered in environmental management as well as complementary coursework for the technical program of each engineering department.

The State Technical Institute at Memphis offers a two year Environmental Engineering Technology program for which an associate degree is awarded upon completion. Middle Tennessee State University provides students with a four-year curriculum in Environmental Science and Technology, a program designed to give students a background of educational experiences associated with environmental quality. Students may choose this subject area as a minor.

Walters State Community College in Morristown offers an associate degree in Environmental Health Technology. Volunteer State Community College offers an associate degree from its Department of Conservation and Environmental Technology. Students have three options: Forest Management, Parks Administration and Wildlife Management.

Interviews with faculty members and data from college and university publications were sources for this information.

East Tennessee State University
Johnson City, Tennessee

Program: Environmental Health (B.S., M.S.E.H.)

Hours required for major: Quarter (B.S.) 198 to be changed to 192 in fall of 1977, (M.S.E.H.) B.S. plus 48. Admission to M.S.E.H. program has a preferred prequisite of 3 years professional experience.
Program Inception: (B.S.) 1964, (M.S.E.H.) 1970
Staff Size: One professor, two associate professors, four assistant professors, two instructors, six graduate assistants (7 Ph.D.s, 2 M.S.)
Enrollment: (B.S.) 200, (M.S.E.H.) 40
Graduates (1976): (B.S.) 42, (M.S.E.H.) 26
Placement: (B.S.) 42, (M.S.E.H.) 24
Graduate Work (Ph.D.): 2

Courses

Personal Health
General Microbiology
Human Anatomy
Human Physiology
Environmental Sanitation
Introduction to Environmental Health
Principles of Epidemiology
Water Supplies and Wastewater Treatment
Accident Prevention
Environmental Control of Insects and Parasitism
Sanitary Drawing
Health Communications
Introduction to Air Pollution
Environmental Safety
Food Sanitation Principles
Solid Waste Management
Human Ecology
Community Health
Environmental Health Practice
Environmental Health Aspects of Housing and Medical Care Facilities
Introduction to Radiological Health
Occupational Health
Toxicology
Introduction to Vital Statistics
Public Health Sanitation
Biological Foundations of Sanitation
Environmental Health Equipment
Environmental Analysis

Environmental Health Program-Planning
Problems in Environmental Education
Environmental Sanitation Survey
Institutional Health and Disease Control
Water Quality Control
Special Studies in Environmental Health
Food-Borne Disease Control
Environmental Program Evaluation
Environmental Health Practice I
Environmental Health Practice II
Principles of Sanitary Science
Environmental Chemistry
Biostatics and Epidemiology
Consumer Protection and Environmental Design
Air Pollution Principles
Air Pollution Control
Water Pollution Principles
Water Pollution Control
Environmental Microbiology
Industrial Hygiene
Institutional Health
Housing Hygiene and Urban Development
Environmental Radiation
Solid Waste Management
Insect and Vector Control
Environmental Health Administration
Environmental Health in Public Health
Environmental Health Management
Environmental Planning
Special Problems in Environmental Health
Seminar
Research in Environmental Health
Thesis

Chattanooga State Technical Community College
Chattanooga, Tennessee

Program: Chemical and Environmental Technology (A.S.)

Hours required for major: Quarter Major 107.
Program Inception: 1972
Staff Size: Two associate professors (2 M.S.).
Enrollment: 5
Graduates (1976): 3
Placement: 3
Graduate Work: 0

Courses
General Chemistry I
Algebra and Trigonometry I
Composition I
Elementary Drafting
Introduction to Environmental Pollution
General Chemistry II
Laboratory Techniques
Algebra and Trigonometry II
Physics I
General Chemistry III
Glassworking
Statistics I
Physics II
Fundamentals of Public Speaking
Stream Biology
Meteorology and Climatology
Air Pollution Control Methods
Quantitative Analysis I
Environmental Sampling and Analysis I
Water and Wastewater Treatment
FORTRAN for Science and Engineering
Electronics I
Environmental Sampling and Analysis II
Air Pollution Laws and Regulations
Research Problems
Electronics II
Report Writing

State Legislation

TENNESSEE AIR

TITLE:

Tennessee Air Quality Act
Tennessee Code 53-3408

PURPOSE:

To maintain purity of the air resources of the state consistent with the protection of normal health, general welfare and physical property of the people, maximum employment and a full industrial development of the state.

DEFINITIONS:

1. Air contaminant
2. Air contaminant source
3. Air pollution
4. Board
5. Department
6. Person
7. Political subdivision
8. Technical secretary
9. Commissioner

ADMINISTERING AUTHORITY:

Department of Public Health
Air Pollution Control Board

AUTHORIZATIONS:

To issue regulations pursuant to the act;
To establish ambient air quality standards and emission standards;
To develop a comprehensive air pollution control program for the state;
To enter and inspect property in enforcement of the act;
To provide technical and scientific assistance in carrying out the purposes of the act;
To act as a state lead agency in air pollution matters;
To administer a permit program for construction and air pollution control devices;

AUTHORIZATIONS (Cont'd):

To issue variances under the act;
To issue emergency air episode orders;
To take such action as is necessary to enforce the act.

PROHIBITED ACTS:

To cause or allow air pollution in violation of established standards;
To violate the provisions of any variance;
To violate any other provision of the act or regulations issued pursuant to the act.

EXEMPTIONS:

Exemptions may be issued for sources which will not substantively effect air quality standards;
Local governmental units may enact own air pollution control programs consistent with state standards.

PENALTIES:

Fines of from $500 to $1,000.

TENNESSEE PESTICIDES

TITLE:

Pest Control Operators Act of 1972
Tennessee Code 62-2101

PURPOSE:

To provide for the classification of pesticide applicators and for the certification of various classes of pesticide applicators.

DEFINITIONS:

1. Charter
2. Commercial pest control operator
3. Pest
4. Certified applicator
5. Private applicator
6. Restricted use pesticide
7. License
8. Registration
9. Office
10. Branch office

ADMINISTERING AUTHORITY:

Department of Agriculture
Pest Control Board

AUTHORIZATIONS:

To establish categories of pesticide applicators;
To certify private applicators and commercial pest control operators;
To require the proper labeling of pesticides;
To issue regulations pursuant to the act;
To require the filing of certain reports under the act.

CERTIFICATION OR LICENSING:

All persons engaging in the business of commercial pest control operator must be chartered;
Other applicators of restricted pesticides must be certified.

PROHIBITED ACTS:

To fail to have the proper license or certification for pesticide activities undertaken;
To violate the conditions of any pesticide license or certification;
To fail to properly label all pesticides;
To violate other regulations or act provisions.

EXEMPTIONS:

Governmental agencies, legitimate experimental uses, and nonrestricted pesticide use on a persons own property.

PENALTIES:

First offense - violation constitutes a misdemeanor and fines of from $100 to $500 or three months imprisonment;
Subsequent offenses - fines of from $300 to $1,000 or 90 days imprisonment.

TENNESSEE POTABLE WATER

TITLE:

Public Water Supply and Sewer System Law
Tennessee Code 53-2001

PURPOSE:

To provide for the control over the construction of public water supply and public sewerage systems to protect the public health and welfare.

DEFINITIONS:

1. Water works system
2. Public water supply
3. Department
4. Commissioner
5. Potable water supply
6. Cross connection
7. Auxiliary intake
8. By-pass
9. Interconnection
10. Public sewerage system
11. Sewage
12. Person

ADMINISTERING AUTHORITY:

Department of Public Health

AUTHORIZATIONS:

To approve public water supply and public sewerage system construction;
To generally supervise public water supplies and sewerage systems;
To issue regulations regarding operation and maintenance of public water supply and public sewerage systems;
To generally enforce the act in promotion of the public safety.

PROHIBITED ACTS:

To undertake any public water supply or public sewerage system construction without a proper permit;
To violate any regulations relating to operation and maintenance of public water supplies and public sewerage systems;
To allow or install any cross connection, auxiliary intake, by-pass, or interconnection in a public water supply system;
To fail to maintain any records required by the department;
To violate any other provisions of the act.

PENALTIES:

Violation constitutes a misdemeanor;
Fines of from $10 to $100.

TENNESSEE RADIATION

TITLE:

Radiological Health Service Act
Tennessee Code 53-3301

PURPOSE:

To provide for the regulation and registration of radiation sources and radiological devices.

DEFINITIONS:

1. Person
2. Radiation
3. Radiation source
4. Department
5. Commissioner
6. Radiation machine
7. Byproduct material
8. Source material
9. Special nuclear material
10. Radioactive material

ADMINISTERING AUTHORITY:

Department of Public Health
Radiological Health Services

AUTHORIZATIONS:

To conduct and participate in studies relating to radiation hazards and radiation health effects;
To collect and disseminate information relating to radiological health;
To issue regulations pursuant to the act;
To enter into cooperative agreements with other state and federal agencies;
To license users of byproducts, source, and special nuclear materials;
To enter and inspect property in enforcement of the act;
To register all radiation machines in the state;
To control the manufacture, use, receipt, possession, storage, and disposal of radiation sources.

PROHIBITED ACTS:

To interfere with enforcement of the act;
To fail to register radiation machines as required;
To violate any other provision of the act.

EXEMPTIONS:

Electrical equipment not intended to produce radiation need not be registered;
Radiation machines not in use or in transportation are also exempt from registration.

PENALTIES:

Fines of from $50 to $100.

NRC AGREEMENT STATE: Yes

TENNESSEE SOLID WASTE

TITLE:

Solid Waste Disposal Act
Tennessee Code 53-4301

PURPOSE:

To protect the public health, safety and welfare, prevent the spread of disease, conserve the natural resources of the state, and provide for a coordinated statewide solid waste disposal program.

DEFINITIONS:

1. Solid waste
2. Person
3. Solid waste disposal system
4. Solid waste processing
5. Solid waste disposal
6. Department
7. Commissioner
8. Health officer

ADMINISTERING AUTHORITY:

Department of Public Health
Local Governmental Units

AUTHORIZATIONS:

To supervise construction of solid waste facilities in the state;
To register all solid waste facilities or sites;
To supervise the operation and maintenance of solid waste facilities;
To approve grants and loans to local governmental units;
To issue regulations pursuant to the act;
To provide technical assistance to local governmental units in solid waste matters.

PROHIBITED ACTS:

To fail to register any solid waste facility or site;
To violate solid waste regulations relating to proper disposal methods.

EXEMPTIONS:

Persons disposing of own solid waste on own property;
Counties of certain populations and governmental organization.

PENALTIES:

Violation constitutes a misdemeanor; fines of from $10 to $100.

TENNESSEE WASTE WATER

TITLE:

Public Water and Waste Water Environmental Health Act of 1971
Tennessee Code

PURPOSE:

To provide for the classification of all public water supplies and waste water systems and to require the certification of all water supply and waste water system operators.

DEFINITIONS:

1. Commissioner
2. Board
3. Certificate
4. Water supply system
5. Water treatment plant
6. Waste water treatment plant
7. Water distribution system
8. Operator

ADMINISTERING AUTHORITY:

Department of Public Health
Board of Certification

AUTHORIZATIONS:

To encourage and promote the certification program;
To classify all water treatment plants, waste water treatment plants, water distribution systems and waste water collection systems;
To certify operators of water treatment plants, waste water treatment plants, water distribution systems, and waste water collection systems;
To issue regulations pursuant to the act.

CERTIFICATION OR LICENSING:

One person in a water treatment plant, waste water treatment plant or water distribution system must be certified;
Certification must be in a grade corresponding to that of the facility;
Certification of all operators is encouraged although only required of one operator per facility.

PROHIBITED ACTS:

To operate a water supply system or waste water system or treatment facility without a properly certified operator;
To perform the duties of an operator without being properly certified.

PENALTIES:

Fines of from $50 to $500.

TENNESSEE WASTE WATER

TITLE:

Water Quality Control Act of 1971
Tennessee Code 70-301

PURPOSE:

To abate existing pollution of state waters, to reclaim polluted waters, to prevent future water pollution, and to plan for the future use of the water resources of the state.

DEFINITIONS:

1. Board
2. Boat
3. Commissioner
4. Department
5. Director
6. Division
7. Industrial wastes
8. Member
9. Other wastes
10. Person
11. Pollution
12. Sewage
13. Sewerage system
14. Waters

ADMINISTERING AUTHORITY:

Department of Public Health
Water Quality Control Board
Division of Water Quality Control

AUTHORIZATIONS:

To classify state waters and adopt water quality standards;
To issue regulations regarding prevention, control, and abatement of water pollution;
To adopt a comprehensive state water quality plan;
To supervise the control of water quality of the state;
To enter and inspect property in enforcement of the act;
To bring actions to enforce the act;

AUTHORIZATIONS (Cont'd):

To act as the state lead agency in water pollution matters;
To administer the state pollutant discharge permit system;
To issue orders relating to water pollulation abatement.

PROHIBITED ACTS:

To operate a sewerage system or make certain discharges without a permit;
To violate the terms of any permit;
To cause or allow any water pollution in the state;
To fail to provide any information as required by the act.

PENALTIES:

General violations - fines of from $50 to $5,000;
Willful violations - fines of up to $10,000 or two years imprisonment;
Liability is also imposed for damage actually caused by water pollution to fish and wildlife.

TENNESSEE ENERGY

TITLE:

Production of Oil and Gas Law
Tennessee Code 60-101

PURPOSE:

To regulate the production of oil and gas in the state and to prevent waste during such production.

DEFINITIONS:

1. Board
2. Person
3. Oil
4. Gas
5. Condensate
6. Casing head gas
7. Pool
8. Field
9. Waste
10. Owner
11. Producer
12. Supervisor

ADMINISTERING AUTHORITY:

State Oil and Gas Board

AUTHORIZATIONS:

To maintain records and make inquiry regarding the production of oil and gas;
To undertake investigations relating to waste in oil and gas production;
To issue regulations relating to the prevention of waste in oil and gas production;
To take such other action as is necessary to enforce the act.

PROHIBITED ACTS:

To cause or allow waste in the production or handling of crude petroleum oil or natural gas.

PENALTIES:

Fines of up to $1,000.